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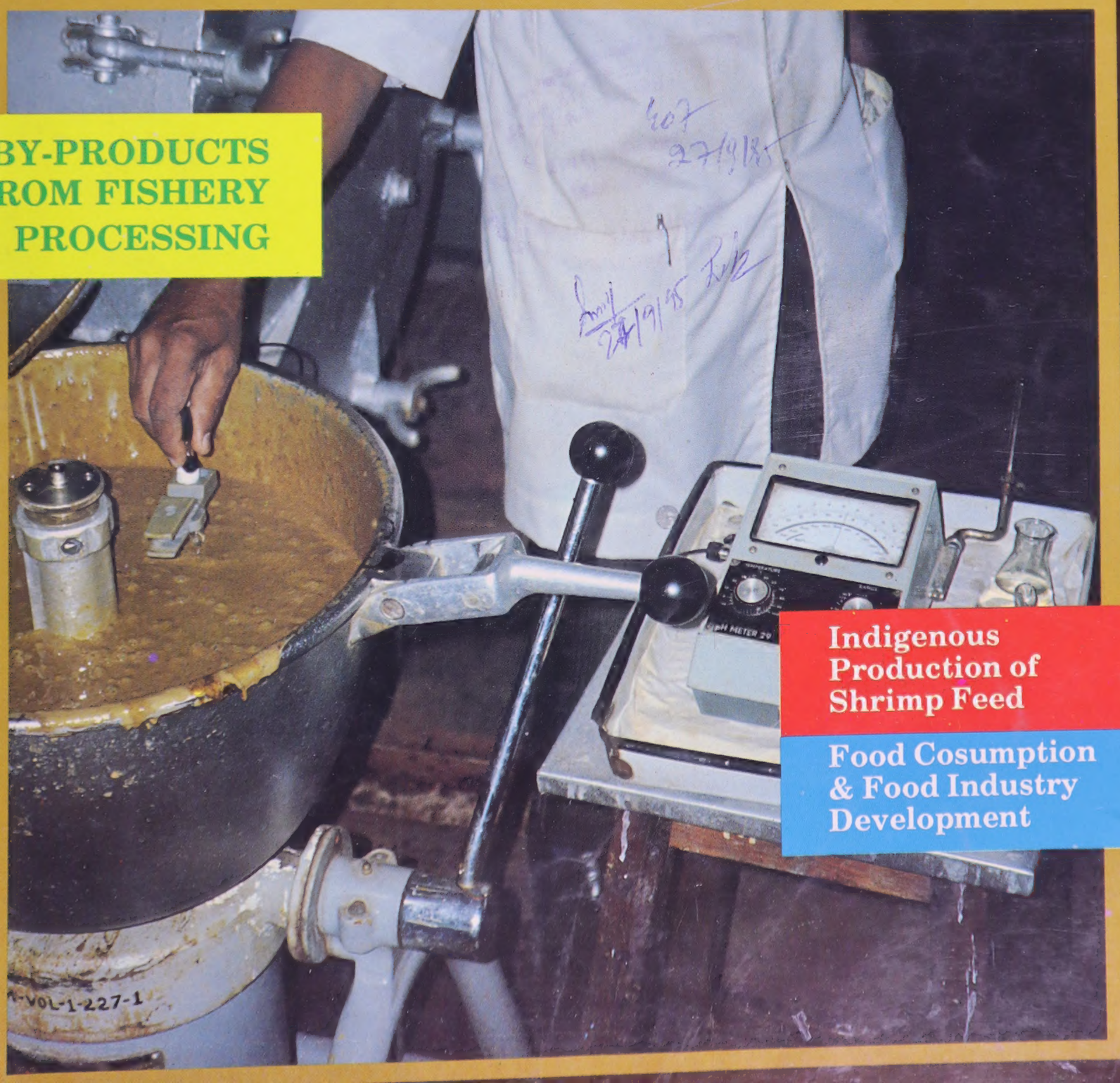
INDIAN FOOD INDUSTRY

PUBLICATION OF ASSOCIATION OF FOOD SCIENTISTS AND TECHNOLOGISTS (INDIA)



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* Affiliated to the Institute of Food Technologists, Chicago, Illinois, U.S.A.
* The Association is a professional and educational organization of Food Scientists and Technologists, with its headquarters at Mysore.
* The chapters of the Association the association are located at Bangalore, Bhopal, Bombay, Calcutta, Delhi, Hisar, Hyderabad, Jabalpur, Jaipur, Jammu, Kanpur, Karnal, Kharagpur, Ludhiana, Madras, Manipur, Nagpur, Pantnagar, Parbhani, Pune and Thiruvananthapuram.

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* Advancement of all the aspects of Science and Technology relating to production, processing and distribution of food, with the ultimate objective to serve humanity through better food.
* Promotion of research, development and training in the Science, Technology and Engineering of Food.
* To provide a forum for exchange, discussion and dissemination of knowledge and current developments, especially among Food Scientists and Technologists as well as the Public and Society at large.

Major activities :

* Publication of 'Journal of Food Science and Technology' (bi- monthly) and 'Indian Food Industry' (bi-monthly),
* Holding symposia/conventions on different aspects of Food Science, Technology and Engineering
* Arranging Lectures and Seminars for the benefit of Members and the Public.

Membership :

* Membership is open to graduates and diploma holders in Food Science, Technology and Engineering as well as to those engaged in these professional activities.
* Types of membership include Life Member, Life Member (Resident Abroad), Corporate Members, Full Member, Member (Resident Abroad), Affiliate Member, Student Member and Student Member (Abroad).
* Each member will receive a free copy of the 'Journal of Food Science and Technology' or 'Indian Food Industry,' as per the option exercised.

For Membership, Subscription to the Journals and other particulars, kindly contact :

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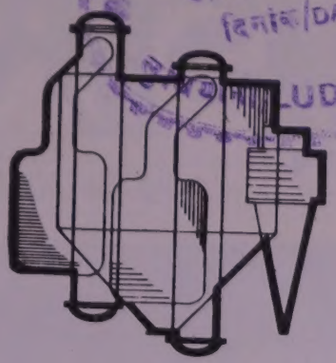

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INDIAN FOOD INDUSTRY

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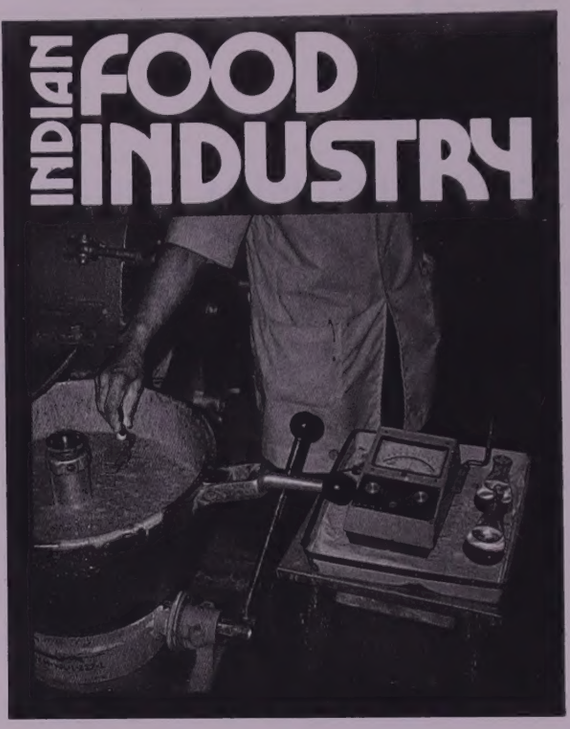

Cover Photo :

Homogenization of fresh-water fish viscera for preparation of fermented silage

Courtesy CFTRI

Indian Food Industry (ISSN-0253-5025) is a bi-monthly publication of the **Association of Food Scientists and Technologists (India)**, devoted to give extensive coverage to technological and market developments relevant to food industries in India.

Review articles, technology papers based on R&D work and reports on various aspects concerning food industry are welcome from food scientists and technologists from industry, research institutions and other related organisations. Contributors are advised to provide good quality illustrations in the form of charts and photographs along with the manuscripts. The Editorial Board reserves the right to edit the manuscripts in order to make them suitable for publication in the journal.

Food industries may send information (suitably illustrated with photographs) about their new products, machinery, business ventures and other developments, which will be published on the discretion of the Editorial Board.

Subscription : All members of AFST(I) are entitled to receive the **Indian Food Industry** journal regularly free of cost, if they opt for it. Members who are receiving **Journal of Food Science and Technology** and desirous of changing over to **Indian Food Industry**, can do so by sending a formal request to the Executive Secretary, AFST(I). Alternatively, they can subscribe to **Indian Food Industry** by paying an additional amount of Rs 50. The regular subscription rates for the journal are as follows :

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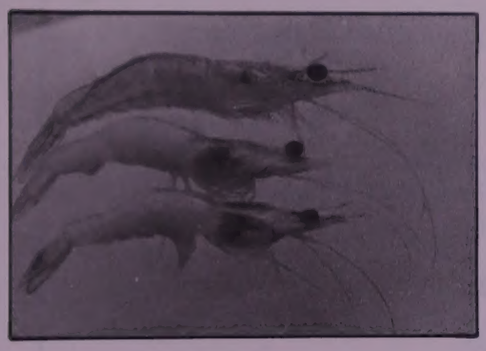

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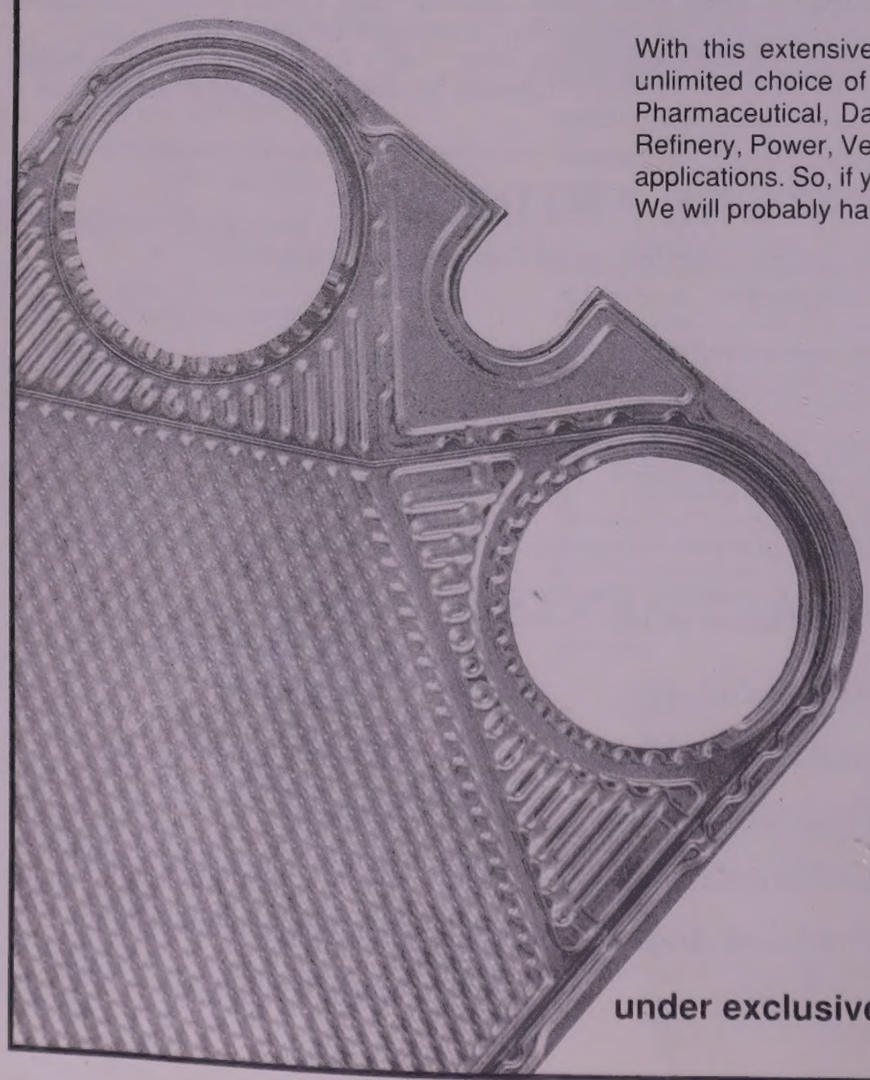

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EDITORIAL

The industrial investment climate in India, has undergone a sea change in the last four years or so, and to be more specific, since the liberalization of economy. The priority assigned to Agro and Food Processing and the potential of agro resources of the country have made agro and food processing, a favourite sector for considering new investments, both for domestic and export markets. The Central and State Governments also have supported this sector with new and friendly policy initiatives. This has triggered the prospecting and scouting for projects worthy of investments, with assured market prospects and attractive returns on investments.

Some of the often encountered dilemmas emerge on this score of project identification with the investors prospecting for novel products, on the one hand, and an assured market on the other. These parameters are something nearly impossible to achieve, atleast in Food Processing. The dictum of assured market, established by the demand supply gap cannot be quantified in real terms for a novel product. However, for established and known products, the market can be estimated and the compromise is novelty.

May be, for the prospective investors, various choices do exist. What is reasonably novel at the target market and a potential demand, a demand that can be generated, the classical technique of cajoling and canvassing the consumers to express their want, at the market place and generate the demand. The concepts of novelty need to be created and tested and hence, need the time and resources to work on the novelty and innovations die down for want of perseverance and lack of resources to support them at the market place. The initiatives such as venture capital from many sources are the most encouraging development at this juncture. It is hoped that the venture capital will get employed at a much more vigorous pace than ever before.

S.P. Pillai
Chief Editor

GOOD NEWS

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INDUSTRY NEWS

CSIR in Marketing Link-up with US Company

The Council for Scientific and Industrial Research (CSIR) has tied up with a US firm, Global Exchange of Technology (GET), for marketing its products and processes around the world.

The tie-up will enable CSIR to market technologies worth $5 million during the next two years.

A memorandum of understanding (MoU) was signed recently between CSIR and GET.

The MoU will enable GET to approach and select CSIR laboratories and negotiate deals with GET's clients for the labs' knowledge base. Initially, GET will market CSIR expertise in chemical sciences and engineering. It will "package" the technology according to the client's needs.

The tie-up will help popularise CSIR technologies in the West.

Individual CSIR labs have already tied up with foreign companies to market their products. The National Aerospace Laboratory has tied up with the Manhattan Business Consulting (MBC), USA to sell its expertise in aerospace sector.

The Palate Pitch

The market ought to propose a toast to Bombay-based International Distillers Ltd (IDL), for launching new liquor brands with such spirited regularity. The company believes in going against the marketing tide by creating segments for entirely new liquor *tastes* in the market. This time round, it's Archer's Peach Schnapps, a peach flavoured Schnapps (a European family of spirits) drink targeted at yuppie men and women. Priced at Rs 280 for a 750 ml bottle, the brand intends to win additional drinkers into the liquor fold by making a proposition of flavour.

Jumping Towards Litchi

Falvour variant-litchi is added to its Rs 25-crores Jumpin brand of tetrapack fruit drinks. So far, Jumpin has been available in four flavours : mango, orange, pineapple and guava.

Litchi has a distinct flavour and is liked by adults as well as children. The popularity of litchi squash and syrup-especially in the North indicates a ready market for the variant. Moreover, it is the only tetrapack offering in this flavour.

Nutritious Niche

The Delhi-based health foods marketer Bagrry's India, has launched Bagrry's Muesli, a ready-to-eat, high-fibre, zero cholesterol cereal food to be eaten with milk. So far, the company's biggest success is Oatex, a brand of oats fibre food.

The company has introduced Muesli in two flavour variants - Crunchy Muesli, at Rs 86, and Choco Chip Muesli (for children) at Rs 90, both for a 425 gm pack. Trial packs of 125 gm are selling too (Crunchy Rs 33, Choco Chip Rs 42).

Initially, the company is targeting the consumer who is already aware of Muesli's generic strengths as a health food. The main ingredient of Bagrry's Muesli is wheat bran which has a good portion of insoluble edible fibre. The product also contains oat bran and white oats, which together provide the soluble fibre - an anti-diabetic and cholesterol-lowering agent. Other ingredients include rolled oat clusters, nuts, almonds, honey, raisins, and walnuts.

For now, the brand will be retailed only in big upmarket outlets in metros and other selected cities. Mass marketing the product, feels the company, would diminish its 'premiumness".

The brand, is positioned to be a premium protein-rich health food to be eaten at *any* time of the day (and not just for breakfast). This makes it more like a Swiss-style instant cereal than the American kinds one is more familiar with.

Starch-based Distillery at Alwar, Rajas-than

House of Kedias is setting up a starch-based distillery at

Alwar, Rajasthan that utilises sub-standard wheat. The unit will be the largest in Asia with a capacity of 66 million litres per year. The use of starch in lieu of molasses makes sense in view of the soaring price of molasses after its decontrol in June 1993. Although they have used starch at their Bhilai and Indore distilleries, it is for the first time in India that starch extracted from wheat will be used.

The inability to use wheat till owes to the presence of wheat gluten, a binding agent which inhibits the sacchari - fication process. But the company has made it possible by using technology developed by the Regional Research Laboratory (RRL), Thiruvananthapuram.

Wheat-based distillation involves the use of enzyme hydrolysis to decompose the starch. The first step in the alcohol extraction process is milling the grain to produce a flour of a specific particle size, a pre-requisite for optimum enzyme action. The bran is removed and the flour mixed with water to produce a thick slurry. Wheat gluten, rich in protein, is then separated from the slurry by gravity. Further, mechanical destruction of the slurry is done by 'jet cooking' it, using steam at 125 to 140 degrees for 10 to 15 seconds. Jet cooking helps burst the grain to produce a gelatinised starch essential for effective enzyme hydrolysis.

Enzyme hydrolysis proceeds in two steps. The first enzyme 'alpha amylase' is added as the temperature of the jet cooked slurry falls to 90 degrees. "The enzyme bio-chemically breaks down the starch into a relatively simpler sugar called dextrin," explains S.V. Ramakrishna, co-ordinator, biochemical processing and waste water technology at RRL. But, fermentation can begin, only when dextrins are broken down into the simplest form of sugar. The second enzyme 'amylo glucosidase' brings about this conversion. Conversion of starch into simple sugars by the two enzymes form the sacchari - fication stage.

Saccharification is followed by fermentation. "Sacchari - fication and fermentation process can be done by two methods," says Ramarkrishna. "It could either be a near-complete pre-saccharification and continuous fermentation or partial pre-saccharification and instantaneous fermentation." Choice of the process depends on the quality of grains apart from other factors. In the first case, saccharification and fermentation by yeast take place separately. In the second case, some initial sugar is produced separately, before saccharification and fermentation by yeast take place in the fermentor itself. Pre- activated yeast is grown separately on bran medium to reduce the lag time. This way the bran becomes a useful material, not a pollutant.

The main pollutant in a distillery unit is the effluents produced during fermentation. But in the present case, the suspended and soluble solid effluents are separated and dried to produce cakes called distiller's dried grain and solubles (DDGS) The DDGS is enriched in protein and cellulose fibre and is a good cattle feed, that would be exported at Rs 4 a kg. A total utilisation of starch and its by-products pre-empts pollution problems and reflects the group's motto of running a zero pollution unit.

Gluten, which has always been the sore point in the case of wheat-based distillation, is taken care of and is best utilised too. A protein-rich product, gluten makes up nearly 13 per cent of Indian wheat. European wheat, however, contains only 8 per cent gluten. They make up this protein deficiency by using additional wheat gluten in their bread. Europe alone consumes nearly 250,000 tonnes of gluten per year. The Kedia group plans to have a 100 per cent export-oriented unit to market nearly 25,000 tonnes of gluten annually to Europe. Gluten sells at Rs 50 a kg.

Shrewd management of the by-products while tackling the pollution problem can have a considerable effect on product cost. The overall production cost of alcohol is expected to be Rs 16.35 per bulk litre. And to make the unit more self reliant and to further save costs, the Kedia group is setting up an in-house facility to manufacture amylo glucosidase enzyme. The unit being set up at a cost of Rs 4.61 crores would have a capacity of 3000 tonnes per year and will save the Kedias another Rs 175 to Rs 275 per kg. To put it in a word, alcohol is distilled without polluting the environment - and saving money in the bargain.

Pierce-Modern Food Combine for Cashewnuts

Pierce Leslie (PL) India Ltd has tied up with the public sector Modern food Industries to introduce the 'Royal Choice' array of packaged cashewnuts. The venture aimed at the domestic market would feature PL processing and packaging the nuts with Modern Industries distribution network being tapped to supply the product to consumers.

Modern Industries covers 13 of Kerala's 14 districts. It has 92 distributors and over 6,000

retail outlets for supplying to the consumers its product 'Modern Bread'.

The strategy of PL with packaged cashew brands is to bring other tree nuts also at a later stage under the same name. PL has a turnover of about Rs. 25 crores.

The planned range of roasted and salted cashew would be available in handy, nitrogen flushed and aluminium foil laminated pouches of 50 gm and 100 gm. Also on the shelves would be 250 gm packs of plain cashews. For housewives, pouches of 100 gm of assorted kernels and an attractive gift pack of 500 gm would be introduced at a later stage.

Western Foods Set to Launch Its Egg Powder Plant

Western Foods Ltd. (WFL), a Chandigarh-based egg processing company, which went public in December last, has recently erected plant and machinery and expects to commence commercial production soon.

WFL is setting up a project, at Golepura in Ambala district, Haryana, to manufacture high value-added items such as egg powder albumen flakes, liquid egg products and related special products. The company also plans to market branded eggs with a long shelf life in domestic as well as in neighbouring West Asian countries.

The project is located in that heart of the egg producing belt of Haryana, where production is about 25 lakh eggs per day. With some modifications and additions in the machinery, the company will now process 3 lakh eggs per day against 2 lakhs envisaged originally.

The company had entered into MoUs with overseas firms to export 80 per cent of its production and it plans to market the rest in the domestic market. With an upward trend in international prices of egg products, the company's break-even point would be 25 per cent with an expected EPS of Rs. 3.20 on an equity of Rs. 4.70 crores for 1995-96, the first year of operation.

Weikfield Tie-up with US Firm

Weikfield group Pune has tied up with Franklin Farms Inc of the US to set up a Rs 28 crore 100 per cent export-oriented unit (EoU) to grow and process 5,000 tonnes per annum of white button mushrooms at Bakori, near Pune.

Franklin Farms will provide technology to grow mushrooms and process them in a manufacturing facility, duly approved by the US Food and Drug Administration (FDA) and European Union (EU) Foods Commission.

The joint venture named Weikfield Agro Products Ltd, will consist of two divisions ; processed mushroom division and the processed vegetables and fruits division.

The entire production of mushrooms will be sold in the $1 billion American market under the buyback agreement with Franklin Farms.

With increased demand for vegetarian food, particularly mushrooms, now looking at India and Mexico as major suppliers for their low production cost advantage, the US company will be importing processed mushrooms packed in cans and bottles.

The Weikfield group will hold 51 per cent equity in the joint venture, while the US company will hold 49 per cent equity.

In the first phase, Weikfield Agro Products will invest Rs 17 crores to procure around 3,000 tonnes of mushrooms per annum. The pilot plant and work of Weikfield Agro's processed mushroom division and civil works of the processed vegetables and fruits division has already begun. Commercial production is slated to begin within the next 18 months.

The processed vegetables and fruits division will manufacture pickles, chutneys, sauces and canned vegetables. These will be exported to West Asian and European countries.

Wheat Exports to Face the Global Challenge

Indian wheat exports will face tough competition in international markets, according to the Internaitonal Wheat Council.

The London-based Council said that a succession of bumper crops has created a huge surplus in India. However, the European Union (EU) too has excess stocks to compete with Indian wheat for the market share.

Compared to the export target of 2.5 million tonnes of Indian wheat, the EU is likely to export 17 million tonnes this year- lower than last year's 19 million tonnes. Wheat

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production in the EU may rise to 891 million tonnes this year, the Council said.

Production in India, however, is expected to maintain last year's level of 58 million tonnes. The report says bumper crops have created storage shortages of India.

India is still seeking a market for its surplus, the wheat report said, though "logistic constraints and the financing of any required export subsidies may militate against a sharp expansion in export shipments".

Changing Flavour of the Market

A Royal battle is brewing in the packet tea market. Lesser known packet tea brands are flooding the market and the big guns are hard pressed to protect their turf.

Today, consumers have the option of at least 200 brands of packet tea, and most are little known names.

In fact, of the two hundred or so different packet teas available, nearly 25 per cent are marketed by small and unknown producers and blenders. The local grocer probably has a tea blend to suit every taste and pocket and he sells these in packets too. Tata Tea's introduction of Taaza in polypacks has led to a spurt of producers following suit.

One reason why so many packets have flooded the market is that retailers have realised that loose tea doesn't command the same price as packaged tea, while the average cost of a packet per kg ranges between Rs 120 and Rs 180 per kg, loose tea is available at between Rs 50 and Rs. 70 per kg. Despite price difference, packaged tea is more popular with middle class consumers.

The problem faced by the larger firms is that advertising and branding costs coupled with administrative costs can often be prohibitive. Smaller producers, wholesalers, and retailers who package teas spend only on the actual packets, given it a name and sell it. The expenditure in this case is minimal.

Market research statistics show that about 220 million kgs of tea are sold through packets, roughly 29 per cent of the country's total tea production. Producers have to offer attractive incentives to retailers to ensure that their brand gets prominent display on the shelves and windows displays - again pushing up their costs.

Of course, tea brokers say that many small producers who have tried to take on the big brands through their packet teas have got their fingers burned. According to them, the intense competition in the market doesn't allow a small player to survive, unless he enjoys a niche segment.

However, going by the number of brands in the market, the prophecies of doom is not deterring new entrants.

Goodricke All Set to Market Instant Tea

Goodricke Group Ltd, part of the UK-based Lawrie group. plans to enter the instant tea market with both cold and hot water-soluble powder.

Goodricke instant tea is mostly meant for export, especially to the US and European Community, where it is becoming increasingly popular.

The company's first instant tea plant with a capacity of 6,00,000 tonnes, is nearing completion at Aibheel in the Dooars region and scheduled to be operational within the next three months. The project cost is Rs 14 crores. It will set up another instant tea plant after the first goes into production.

The firm has recently completed a packaging-cum-tea bagging project near Bombay at a cost of Rs. 15 crores to meet its export requirement.

The poor profitability was due to a massive loss of business with Russia, Poland and other East European countries, as it was the case with most other quality tea exporters to this region.

Cake Mix by Brown and Polson

Corn Products Company (India) Ltd, has extended its popular Brown & Polson brand of custard powder to cake mixes.

Brown & Polson Cake Mix has been launched at Rs. 24 and 26 for chocolate and vanilla flavours, respectively, of a 250 gms pack, which yields half a kilogram of baked cake.

The idea of entering the category came from a market research study, which reveals that when it comes to baking a cake at home, most housewives develop cold feet.

The product also appeals to the working housewife, who finds little time to make cakes the traditional way. The company claims that Cake Mix, which contains de-germ wheat flour, greatly simplifies the process of cake baking.

The housewife merely needs to add three eggs

(vegetarians may replace egg with curd) and 125 gm of butter to the packet, beat the batter for three minutes, and put it into an oven. It takes between 10-35 minutes for the cake to be ready, depending on whether the oven is a microwave or a regular one.

Cake Mix was launched in Calcutta in January this year, and is now also available in Pune, Delhi, Goa and Bombay. By 1995 end, it will be selling in the rest of the metros and towns as well.

Corn Products is looking at the over two million oven-owning households in India.

Apart from Brown and Polson custard powder, CPC India also has in its portfolio, other brands such as Trinka soft drink concentrate, Glucovita energy tablets, and Rex jelly and jams.

Now It's Coffee's Turn ! 'Dip, Dip, Dip'

Coffee bags, a logical extension of the instant cuppa, have now been introduced by the Karnataka-based Rs 62 crore Consolidated Coffee Ltd, Asia's largest coffee plantation company.

When dipped in boiling water, Coorg coffee bags give a cup of pure filter coffee in a jiffy. This convenience has caught the fancy of consumers in Delhi, where they were launched in January. Though traditional south Indians, for whom nothing but ground coffee will do, may turn a disapproving eye, northerners being more sanguine. According to market sources, the offtake is 8 tonnes a month (or 80,000 packets), as against 5 tonnes of tea bags.

The pricing is aggressive. Coorg coffee bags are priced at Rs 25 for 100 gm or 25 bags to a packet, which works out to just a rupee per cup. This is a steal when compared to instant coffee prices - 100 gm of Bru costs Rs 50, while Nescafe costs Rs 84 for the same weight. Industry experts say that while price is important, it is not the only factor influencing consumer acceptance.

For Conscofe, the price advantage comes from its sheer size as well as the fact that unlike other coffee marketers, Conscofe also does its curing, grinding and packing. This is clearly an advantage that Conscofe enjoys over its competitors who have to depend on the coffee board or other planters for coffee seeds and hence are prone to the vagaries of the fluctuating coffee market. Its pricing advantage also stems from the very manner in which instant coffee is made. It takes 2 kg of filter coffee to make 1 kg of instant coffee, which adds to the cost of instant coffee.

Marketing costs are being kept to the minimum. For instance, instead of a big-splash ad campaign, it has opted for mobile posters. That is, 260 young boys and girls were hired to be stationed at retail stores, where they have been extolling the virtues of Coorg coffee bags.

Coorg coffee bags are marketed in Delhi through 45 stockists, but are soon to make their appearance elsewhere. Recent market research revealed demand for the product among the young and the professionals in homes and offices. The company's earlier plan was to restrict coffee bags to the northern market. Reason being that Conscofe has a highly successful brand in Coorg pure filter coffee in the south, the offtake of which, according to market sources, is said to be around 180 tonnes a month.

Bags to be sold in the south will have a different blend, which is stronger. While Coorg coffee bags are packed in zip-locked pouches to retain their freshness and aroma of coffee, for the purist they will remain an alternative between filter coffee and instant coffee. Thus, coffee bags are not expected to eat into the Coorg powder coffee market.

Instant Fruit Drink Powder

Ahmedabad-based Pioma Industries has launched Rasna International, an instant fruit drink powder concentrate, in the domestic market. The mix-and-drink product was developed for exports, and has been selling in Russia, Sri Lanka and Nepal, besides some West Asian markets, since January 1994.

Rasna International is available in two falvours-orange and mango. A 500 gm jar is priced at Rs 89. The orange flavour is also available in a 25 gm sachet, priced at Rs 4. With the launch, Pioma moves beyond the economy platform of its flag-ship brand Rasna, and reaches out to a wealthier consumer.

Claimed to contain real fruit powder, plus vitamin C and five other vitamins and minerals, the brand is positioned as a soft drink, which also offers nutrition - and not as a breakfast drink, as is Tang, the global leader in this category.

Tang made an attempt to create a market for the product in the late '80s, but met with failure. Pioma puts Tang's stumble down to distribution hurdles. It says it has no such problem and is offering the product at the right *price*.

Hamdard Launches Fruit Squashes

Hamdard Laboratories, the Delhi-based marketer of the rose drink, Roohafza, has launched lemon and orange squashes under the house label, Hamdard.

The quashes are priced at Rs 32.50 for a 700 ml bottle, and are slapped with paper labels, which make clear their lineage. The bottles are designed to resemble those of Roohafza.

Squashes form a part of a segment of pulp-based drinks estimated by the company at Rs 120 crores. Hamdard has re-entered the pulp-based segment after 30 years. In the '60s, the company made an attempt to sell Fruit Crush, an orange juice, which failed.

Now, Hamdard considers the market ripe, as was borne out by a test marketing effort undertaken last year in Delhi, Bombay, Chandigarh and Jaipur.

The squashes are targeted at the middle and upper-income buyer. The products are distributed through the company's four branch offices, three depots and 40 distributors, which span the country's retailers.

The company intends to pose a tough challenge to the leader, Kissan (a brand marketed by Brooke Bond Lipton India Ltd), which dominates the pulp-based drink segment with a share of about 70 per cent.

Heritage Packaging

Heritage packaging is at present engaged in the manufacture of flexible packaging material with an installed capacity of 1,200 tonnes per annum (TPA). The existing facilities include rotogravure printing, lamination and pouch making. The company is coming out with an initial public offering (IPO) to expand the existing flexible packaging material manufacturing capacity from 1,200 TPA to 1,800 TPA. It also proposes to go in for backward integration by creating production facilities for extrusion of poly film and manufacture of rotogravure cylinders. The backward integration projects are meant for captive consumption.

The raw material required for manufacture multilayer packaging materials are BOPP films, polyester films, aluminium foils, paper, adhesives and ink reducers. The company proposes to go in for backward integration for production of multilayer film in house. The raw materials required for manufacture are LDPE, HDPE etc. The company intends to procure the raw materials indigenously and is unlikely to face any problems in the raw material procurement. The backward integration programme is likely to ensure better quality materials for lamination and pouch making.

The flexible packaging material mainly finds applications in food processing, chemical and *pan masala* industries.

The commercial production on the expanded capacity is expected to commence by July 1995. The profitability projections appear to be on the higher side, when compared to operating margins achieved by major players and average industry margins. This IPO may offer a limited potential of capital appreciation.

From Explosives to Mushrooms

Premier Explosives Ltd (PEL), diversifying into mushroom cultivation, has entered in to an agreement with Traymaster Ltd of the UK for procuring technical know-how for the project.

The 100 per-cent export oriented unit, being set-up at Kallakal village near Hyderabad, envisages to produce 3,000 tonnes of white button mushrooms per annum.

Mushroom Boom

Ponds India Ltd is sending out container loads of mouthwatering, ultra-pure white button mushrooms chiefly to European destinations.

Fresh investments pouring in from all regions of the country and several companies are tapping the capital market in a big way to finance their plans.

Companies dealing in mushrooms are upbeat about their future. However while the export market is booming, the domestic market remains almost untouched. The business of mushrooms is attractive owing to its short gestation period, just a few months, as well as the flexibility it offers in the addition of capacities with every new 'growing room'.

The product also has an instant overseas market and growth in the Indian mushroom industry has come as a bonanza for leaders such as Dalsem Veciap B.V. Agrisystems Engineering and Consultants B.V. Netherlands, which supply the plants.

Almost all the large manufacturers have advanced canning facilities along with their mushroom growing rooms keeping the export market in sight. For Indian markets, farm fresh mushrooms are being packed for immediate delivery.

Growth of Fruits and Vegetables Processing Sector

Rajya Sabha was informed that the production of processed fruits and vegetables increased by 30.28% in the year 1992-93 and 23.66% in the year 1993-94. During the same period, milk products in the organised sector grew at around 8.5% and 8%, respectively. Growth rate of soft drinks was around 8% and that of beer averaged at 10-15%. Growth of marine fish products was 5.2% in 1992-93, but had fallen to 4.43% in 1993-94.

Processed Food Products Identified as Extreme Focus Items

The Ministry of Commerce had identified the following products as Extreme Focus Items for export purposes : Processed mushroom; Tomato paste; Tropical fruit, fruit juices, pulp and concentrates; Buffalo meat; Ovbar Gum; Alcoholic Beverage; Marine products; Long grain rice.

Source : CIFT - Food Business Bulletin

New Products/Inventions in Biotechnology

A Japanese company, Toyo Engineering Works Ltd. is marketing the Tordus organic garbage and sludge process, which uses micro-organisms to breakdown the material within 24 hours. The equipment uses a specially designed expander, carbon dioxide and water vapour to promote fermentation and eliminate obnoxious odours and high temperatures. Four models with capacities ranging from 250 kg to 1,000 kg are being offered. (Japan High Tech Report).

Proposals Invited for Joint Venture with Canada

The government of India had signed a Memorandum of Understanding with the Government of Canada on Industrial and Technological Collaboration in February 1987, which envisaged expansion of bilateral industrial cooperation, two way investment in areas of complimentary interest and also exchange of visits of officials of both government and representatives of industry from both countries.

Food Processing Industries as also pharmaceutical and health care products have been identified as important areas for Indo-Canadian cooperation.

The Ministry of Industry invites specific proposals on the sector with project profiles, which will specifically indicate the type of Canadian involvement sought, on the basis of which the composition of a delegation of Canada will be finalised.

Interested companies and organisations may forward their proposal if any to CIFTI.

Proposals for 100% EOUs

During 1993-94, 148 proposals for 100% EOU projects in processed food, aquaculture and deep sea fishing have been approved, of which 40 are in the State of Andhra Pradesh, 27 in Maharashtra, 15 in Tamil Nadu and 10 each in Kerala and Haryana.

Enzyme-based Fuel Additive

Osten Enzyme India of Madras, through an Indo-Japanese joint venture for advanced research and development in biotechnology, has started manufacturing an enzyme-based fuel additive, which could save upto 15 per cent of fuel in all combustion applications. The fuel additive was originally extracted from a group of India herbal plants, with the help of Japanese biotechnology. Its application is currently being studied in defence vehicles at the Avadi, Tamil Nadu-based combat vehicle R&D establishment.

The additive is an effective combination of nature enzymes and organic materials with a petroleum base. The organic nature has made it perfectly safe for use in all IC engines. The company has commenced production with 20 kilolitres of additive per month. the Japanese collaborator plans to export the product to the

developed countries, which include Germany and USA.

Under the joint venture introduction of bio-fertilizers, bio-feeds and bio-pesticides is also planned. (Japan High tech Report).

Foreign Investment in Food Processing Sector

Since liberalisation, the Government has approved 195 cases of foreign investment by foreign companies/NRIs/OBCs in food processing, deep sea fishing and aquaculture sectors. Conditions for such approvals include dividend balancing and foreign exchange neutrality over a period of 5-7 years.

The 195 proposals so far approved involve a foreign investment of Rs. 25.28 million. Of these, 44 proposals, involving a foreign investment of Rs. 5.29 billion have already been implemented.

Major Edible Oils Placed under OGL and Import Duty Reduced

The Government has decided to shift major edible oils to the Open General Licence list effective from 1st March 1995. The items shifted to OGL are groundnut oil, sunflower oil, rapeseed oil, soyabean oil and cottonseed oil.

The Government has also announced reduction in import duty on major edible (vegetable) oil including palmolein to a uniform level of 30 per cent ad valorem. This applies to vegetable oils, other coconut, RBD palm oil. RBD palm kernel and palm stearin, which will continue to attract 65% customs duty. Thus, groundnut oil, safflower oil, rapeseed oil, soyabean oil, cottonseed oil and significantly palmolein are now freely importable at the reduced rate of 30% customs duty. (*Source : Economic Times*).

Anil Starch and CPC International Form Alliance

Ahmedabad-based Anil Starch Products Ltd., a member of the Lalbhai Group, engaged in the manufacture of starches and starch derivatives (viz., glucose etc.) has entered into a collaboration with CPC International Inc., one of the largest corn refining companies in the world. This agreement gives Anil access to new technologies, which will enable them to manufacture quality products of international standards.

CPC, a FORTUNE-500 company headquartered in the United States, has been in the business for 90 years and has more than 150 plants in 60 countries. It produces branded consumer food products and corn refining products used by more than 60 basic industries.

According to the agreement, CPC would assist in instrumentation and automation of processes, which would have a positive impact on product quality as well as energy consumption. The alliance with CPC will give Anil access to a vast data bank of application technologies. Anil will also have access to the application laboratories of various CPC companies worldwide. The agreement envisages CPC's assistance in customer servicing and market development also.

SSL Opens Automatic Chicken Dressing Plant

Starchik Specialities Limited has inaugurated the first and most modern semi-automatic chicken dressing plant in the State at Chevella near Vikarabad.

The plant from Stork of Holland has a capacity to produce 12,000 dressed chicken per day. The plant, spread over a sprawling 25- acre plot, was set up with a total investment of approximately Rs 5 crores.

The chicken is produced at this plant in totally hygienic environment of international standards. The process of freezing chicken immediately after dressing ensures freedom from bacterial infection. The whole process will be done in a total pollution- free environment. With this, the company will fulfil the customer's long-felt need for fresh frozen chicken in various forms, hygienically produced and conveniently packed.

The plant will market prime cut chicken, Andhra cut chicken, boneless chicken and chicken parts like legs, etc.

Starchik Specialities has already commenced production and achieved a turnover of Rs 400 lakhs for the year ended March 31, 1995. The company has already entered into supply agreements with almost all star hotels in Hyderabad, including the Taj and Oberoi group of hotels. The agreement with the Taj group for supply to their

hotels in Madras has also been finalised.

The company's export division started exports and in the three months (January-March 1995), the total foreign exchange earnings were approximately $45,000. The profit for the current year is expected to be about Rs 25 lakhs.

Britain to Buy *Banginapallis*

Andhra Pradesh Government has chalked out an ambitious programme to export the delicious *Banginapalli (Benishan)* and other varieties of mangoes, besides seedless grapes, pomegranates, *Sapota* and bananas to Britain and other European markets.

Disclosing this to newsmen, the State Minister for Agriculture, Mr K Vidyadhar Rao, said that the government was also trying to find a suitable organisation to establish greenhouses through a joint venture with the Holland-based Rovero Co in Hyderabad to boost floriculture.

Mr Rao, who led a delegation comprising the Minister for Marketing, Mr K Srihari, two fruit exporters and others, on a 10-day export promotion tour of Britian and other European countries recently, said that the *Banginapalli* variety was liked by the people and importers there.

The government has decided to distribute half a tonne of *Banginapalli* mangoes free of cost in select British and other European markets as part of its export promotion programme.

"We are sure of bagging a big export order, provided we maintain the quality and the kind of packaging prevalent in the West. We have gone there to tap the export market and not to bring orders." Mr Rao said.

The Agricultural Processed Food Products Export Promotion Development Authority will share a part of the air freight. The State Government will provide the infrastructure to the horticulturists to help produce quality fruits.

Mr Srihari said that the West gave much importance to post- harvest technology-grading, processing and packaging - besides maintaining the cold chain from the garden to the shop shelf.

The cooperatives in market yards are run on sound lines in these countries.

Mr Rao said that India could also have its presence felt in floriculture. A major greenhouse company in Holland has expressed keen interest in setting up a greenhouse in South India.

A company from Israel has also come forward. These companies have found the weather in Hyderabad and Bangalore to be suitable for development floriculture.

The Minister said that the Government would take a decision soon in taking the help of a consultancy firm in this regard.

Som Datt Enters German Alliance to Produce Beer

Som Datta Breweries Limited, a Som Datt Group Company has collaborated with Lowenbrau AG Munich, Germany to set up a most modern with state-of-the-art technology brewery plant in Rajasthan for the manufacture of World's best known and most respected brand of beer 'Lowenbrau'.

Som Dutt Breweries Ltd is proposed to set up a brewery with a total capacity of 200,000 HL with an extra capacity in the brew house and bottling plant in order to increase the capacity to 500,000 HL by adding the additional equipments in stages. The total cost of the project will be approximate by US $11.1 million (Rs 35 crores) and the beer is slated for an April 1996 launch.

The company has a very sound financial base having reserves of around Rs 750 million.

The latest addition to the Som Datt Group of companies is Som Datt Petroleum Ltd. As a part of globalisation and parallel marketing policy of government of India, some of the petroleum products including Liquid Petroleum Gas (LPG), which were hitherto being marketed by the public sector, have been decanalised for marketing by private sector companies. The company is planning to enter into LPG marketing on a large scale, keeping in view an additional potential of approximately, four million tonnes per year by the turn of the century. The company planned to have their own dedicated LPG import facility at one of the ports, duly backed up by sufficient large storage capacity and bottling plants. The project involves a capital outlay of about US $ 20 million (Rs 640 million approx) in the first phase and another US $ 20 million (Rs 640 million approx) in the second phase.

100% EoU Multi Fruit Processing Unit at Tirupati

A 100% EoU, Vinsari Fruitech Limited, Multifruit Processing Unit is being set up to process mango, guava, Papaya and tomato at Tirupati, Andhra Pradesh. The total project outlay is Rs. 13 crores. The plant shall be processing 6,800 MT tonnes of aseptically packed concentrates, operating 280 days in a year. Total plant is being imported on turn-key basis from Manzini Comaco, Italy. Total product shall be exported to USA and Europe through firm buy-backs. The project is under very fast implementation and shall be coming for production by next mango season i.e., by april 1996. The project is being promoted by young and progressive thinking technocrats from Tirupati.

Projects Cleared by the Directorate of Commerce and Industries - Karnataka.

Following are the projects cleared by the Directorate of Commerce and Industries, Karnataka, through Single Window Assistance (SWA) during January, February & March 1995

Name of the Unit and address	Factory location	Products manufactured	Investment (Rs. lakhs)
Bidar common effluent treatment (P) Ltd 5-9-88/2 Saphire Building, Fateh Maidan Hyderabad 560 001	Kolhar Indl. area Bidar	Common effluent plant	200
Murudeshwara Foods & Exports Ltd., Honnavar - 581 334 Karnataka	Baikampady Indl. area Mangalore	Ice mfg & cold storage plant	111
Brooke Bond Lipton Ltd. 9, Shakespeare Sarani Calcutta - 700 071	Hebbal Indl area, Mysore	Tomato products	4978
KLN Agro-Tech (P) Ltd. 9/2, Nandidurga Road, Benson Town, Bangalore - 560 046	Antharasanahalli Indl. area Tumkur	Bakery fat and margarine	1367
Tulsyan Synthetics (P) Ltd. 79/A, New Bamboo Bazaar Bangalore - 560 002	Doddaballapur Indl. area Bangalore (R) District	Flexible Intermediate bulk containers	758
RKS Agrotech Ltd. No.8, Hu-chi-Minh Sarani Calcutta - 700 071	Jingai Indl. area Anekal, Bangalore (U) District	Spice oil Oleoresin, Essential oil etc.	1365
Recon Limited Basavanagudi, Bangalore	Jigani Industrial Area Anekal Tq, Bangalore Dt.	Pesticides formulation	492
Bhagavathi Agro Industries Hulima, Bangalore - 560 076	Medahalli, Anekal Tq Bangalore (R) Dist.	Button mushrooms	673
Varsha Dairy Limited Chowk Bazaar, Jugasali, Jamshedpur	Bangalore	MILk processing unit	300
Pix Autos Limited B. No.13, Liberty Shopping Centre Hill Road, Bandra, Bombay - 400 050	Plot No.35, E KIADB Indl. area, Hoskote, Bangalore(R) Dist	Freeze-dried food products	637
Nestle India Limited M-5A, Connaught Circus P.O.box No.611 New Delhi 110 001	Plot No. 51,52,53 KIADB, Indl. area Nanjangud, Mysore District.	Energy food drink	650
Shree Ghataprabha Co-op. Agro based Industry Ltd., Zangatihal, Hukkeri Tq. Belgaum Dist - 591 306	Zangatihal Hukkeri, Belgaum Dist.	Soyabean oil extraction and refining unit	468

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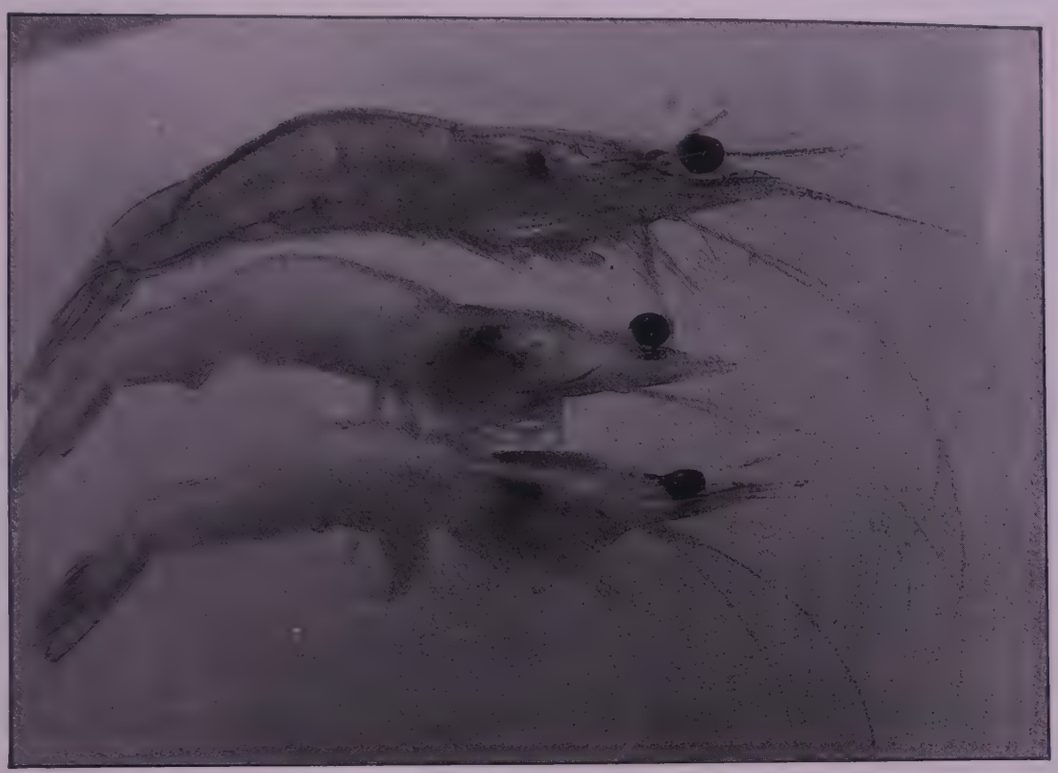

By-products from Industrial Fishery Processing

Indigenous Production of Shrimp Feed

Trends in Food Consumption and Food Industry Development - A Global Perspective

By-products From Industrial Fishery Processing

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Introduction

The marine products sector in India has been steadily growing, having a potential of about 4.5 million tonnes of fishery items available for processing. The seafood industry is mostly export-oriented, the exported 23,900 tonnes of fishery products being worth Rs. 2468 crores in 1993-'94. Naturally, industrial processing of the marine products generates a large amount of wastes. About 45% of the processed seafoods consists of shrimp and therefore, a major share of industrial wastes comes as shell and head of the processed crustacea. Processing of finfish on an industrial basis leaves behind a large amount of head, viscera, scales as wastes. Apart from these, several species of fish such as shark, which are landed are not commercially very important and as such, they are considered by-catch or non-conventional species. There is a large potential for recovery of valuable products from these resources. This article deals with some of the major by-products that can be recovered from wastes from industrial processing of marine products.

Shrimp Waste

The shrimp industry from harvest through various processing operations produces about 30-40% of potential recoverable proteinaceous by-products in the form of shrimp heads and shells. Significant worldwide increases in crustacean aquaculture has also added tremendously to this resource. The shrimp waste available in India is estimated to be about 60,000 tonnes per annum (Ramachandran Nair and Madhavan, 1987 ; Udgate and Khuntia, 1994). Apart from being a rich source of chitin, it can be used as a source of flavour components for processed seafoods as well as livestock feed formulations, including diets of farmed shrimp, since it contains essential amino acids and nucleotides. Shrimp waste is also used as a natural source of carotenoids for pigmentation purposes to impart colour to cultured fish species, such as salmon and trout (Simpson, 1988). Shrimp wastes are generally dried and the product varies in composition, depending upon the species of shrimp, contents of head and hulls and dehydration methods used. Machine-peeled shrimp waste contains generally higher amounts of proteins than hand-peeled resources. Because of these variations, the contents of protein and chitin vary greatly. On protein basis, the sun-dried whole shrimp head (shrimp meal) is superior, having a protein content of 69%, followed by 17% ash, 5% calcium, and 1% phosphorus. On the other hand, shrimp shells contain 23% proteins, 31% ash, 27% chitin, 11% calcium and 3% phosphorus.

The shrimp industry from harvest through various processing operations produces about 30-40% of potential recoverable proteinaceous by-products in the form of shrimp heads and shells.

Chitin and Chitosan

Chitin is the most abundant polymer found in marine invertebrates, insects, fungi and yeasts, posing a waste disposal problem for the industry. Shrimp, crab, lobster, squid and craw fish contain 14-35% chitin on dry weight basis. Chitin is a linear polymer of N-acetyl D-glucosamine and glucosamine, while chitosan is obtained by

deacetylation of chitin by enzymatic or microbiological methods. Chitin is insoluble in water and most organic solvents.

The process of preparation of chitin from shellfish waste consists of demineralisation of dried and pulverized raw material, deproteinization with NaOH or enzymes, decolouration, washing and drying. The shells need demineralisation under controlled conditions to prevent deacetylation of chitin. The carotenoproteins may be removed by treatment with trypsin in presence of EDTA. Chitin is further processed into chitosan by deacetylation,which may be achieved by chemical (hot concentrated NaOH) or biological (using chitin deacetylase or using microorganisms, such as *Mucor rouxi, Mucor mechei, Aspergillus niger* etc., which produce the enzyme.

The processing of chitin and chitosan has been recently described by Simpson *et al* (1994) and Madhavan and Ramachandran (1974). About 2000 tonnes of chitin can be recovered from shrimp waste available annually, in India. The polyelectrolyte nature of chitosan makes it a more valuable product than chitin for applications as diverse as flocculating agent for the clarification of fruit juices or treatment of fish processing waste water, dehydrating agent for concentration of alcoholic beverages and industrial alcohol, hemostatic blood coagulant, immobilization of whole cells and enzymes, biomass recovery and functional ingredient for food and pharmaceutical applications. Other uses of chitosan include improving functional properties of packaging materials, removal of heavy metals, such as mercury from water (Table 1). Chitosans from different sources have different properties, the variations being dependent upon the source of chitin, isolation procedures employed and subsequent processing to chitosan. The quality of chitosan is determined by the viscosity of the solution. Chitin has been found to promote growth of broiler chicks, when incorporated in feed at a concentration of 0.5% (Ramachandran Nair and Madhavan, 1987 ; Knorr, 1984, 1991).

Chitin is the most abundant polymer found in marine invertebrates, insects, fungi and yeasts, posing a waste disposal problem for the industry.

Carotenoids

Carotenoids are a group of pigments that contribute to the yellow, orange and red colours found in the skin, eggshell or exoskeleton of aquatic animals. Carotenoids occur in molluscs (clam, oyster and scallop), crustacea (crayfish, lobster, crab, shrimp) and fish (salmon, trout, sea bream, red snapper and tuna). Some of the important carotenoids consist of beta-carotene, lutein, astaxanthin, as-

Table 1 Some Uses of Chitin and Chitosan

As growth promoter in poultry feed, source of dietary fibre improvement of functional properties of packaging material, food thickener/stabilizer
Reduction of cost of packing materials,
Paper making additive
Removal of heavy metals from water. Also for removal of contaminants like PCBS
Clarification of beverages (e.g., wine)
In biotechnology for cell/enzyme immobilization, plant protection (suppression of parasites)
Cosmetics
Biomedical applications
Bile salt sequesterant, anti-coagulant, vascular grafts sutures, artificial kidney membranes.

tacene and tunaxanthin. Beta-carotene is a common carotenoid, which is a major source of vitamin A for animals. Astaxanthin is perhaps the most important marine pigment and is found in a very diverse group of sea animals including lobster, shrimp, salmon, red snapper and others. Astacene is, generally, a breakdown product of astaxanthin, although it occurs in some shellfish and fish. Crustaceans can convert beta-carotene to astaxanthin.

With the rapid increase in aquaculture, the pigments from shellfish waste has become useful. The pigments can be incorporated in the feed in order to enhance the flesh colour of cultured fish and shellfish, since they are unable to perform *de novo* synthesis of the carotenoids.

In order to recover the carotenoids, the shellfish waste is initially deproteinized with trypsin in the presence of EDTA (Simpson and Haard, 1985, Simpson, 1988). The residue is dried and extracted with acetone to recover the pigments. The shrimp meal obtained after dehydration of the shellfish waste consists mainly of astacene and astaxanthin ester with smaller proportions of astaxanthin, lutein and other minor pigments.

Silage

Another process to make use of shrimp waste is its ensilation. For this, the pH of the shrimp waste is lowered by the addition of formic, propionic or inorganic acids. A suitable species of lactic acid bacteria is inoculated into the substrate, which is then incubated at ambient temperature. Cooked rice, cassava or molasses is added as an energy source for the microorganism. Liquefaction of 60-70% of shrimp waste takes place within 2-3 days, as the enzymes breakdown the proteins. About 85% of chitin remains in the sediment. Separation of the silage by centrifugation or pressing gives a liquid, which can be dried onto a carbohydrate carrier to give an animal feed. The technology for production of silage has been discussed by several authors (Arason, 1994 ; Hall and deSilva, 1994 ; Sachinda *et al*, 1994 ; Gildberg, 1993; Ariyani and Buckle, 1991 ; Ackman 1988).

The shark resources provide large amounts of at least two valuable by-products, namely, its skin for processing into leather products and nutritive oil which can be recovered in significant quantities from its liver.

Enzymes

A large scale process for the recovery of enzymes in waste water from the shrimp processing industry has been reported. The water used in the thawing of frozen raw shrimp, was flocculated by ferric chloride, concentrated by cross-flow ultrafiltration and then freeze-dried. Alkaline phosphatase, hyaluronidase, B-N-acetylglucosaminidase and chitinase were recovered in good yield (Olsen *et al*, 1990).

By-products from Finfish Processing Wastes

Processing of finfish gives rise to several types of wastes, which include scales, skin, viscera and bones. These can be processed to give a number of valuable by-products. The feasibility of making these products depends upon the type of fish and quantity of waste generated during its processing. Further, a number of fish species has limited food value and therefore, can be directly used for recovery of valuable secondary products. Various possibilities of utilization of low-cost fish species for food purposes have been discussed elsewhere (Venugopal 1995).

Leather

Several species of shark are available in large quantities as by-catch in India. However, shark meat has poor consumer value, due to its characteristic flavour, although some meat is exported after salting and drying. The shark resources provide large amounts of at least two valuable by-products, namely, its skin for processing into leather products and nutritive oil which can be recovered in significant quantities from its liver. For processing leather, large-size (1.5m) fish are preferred, as they have large usable surfaces.

The processing of shark skin consists of soaking of raw material in an alkaline treatment solution, liming, pickling and tanning followed by neutralization (Bostock, 1991) (Fig.1). Good quality leather can be produced by small scale tanneries in India, using shark caught by artisan fishermen as long as the quality is maintained and adequate training provided in skinning skills. The price of the finished leather is about Rs.35-50 per sq. ft., depending upon finish and quality. The leather compares favourably with that of goat, sheep, and buffalo in durability, strength and price. Leather from shark species such as black tip, hammer head, Indian dog shark, thresher and squalus has been produced in India. Skin has also been prepared from fish such as ghol.

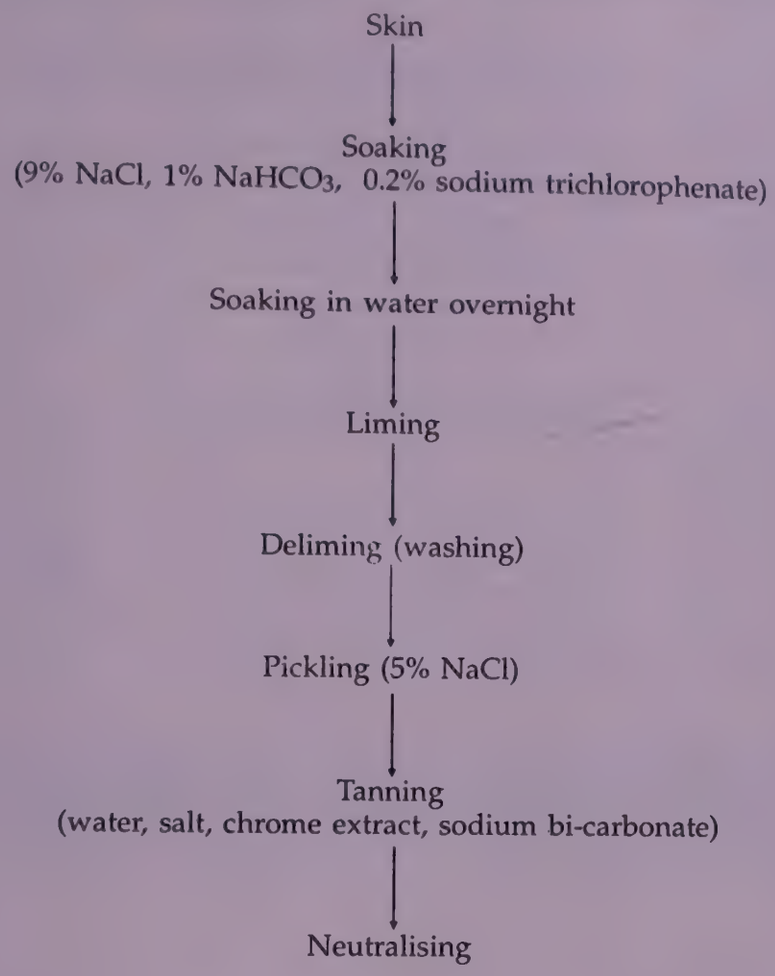

Fig. 1 Processing of Shark Skin

The fish skin and gut can also serve as sources for preparation of collagen and gelatin. Surgical sutures have been developed from fish collagen (Mukundan *et al.*, (1987), while gelatin prepared by mild acid treatment of collagen can have several food applications.

Shark Liver Oil

Shark liver oil has attracted commercial interest for the last 40-50 years because of its high contents of vitamins A and D. It also contains significant (more than 60% in the case of shovenose dogfish liver oil) amounts of total hydrocarbons (squalene and pristane) and diacyl glyceryl ether (about 25%). The recovery of oil from shark consists of natural decomposition of liver, acid ensilage in presence of formic acid, alkali digestion and steam rendering (90^0C for 30 min) (Table 2). Traces of antioxidant,such as TBHQ (tertiary butyl hydroxyquinone) protects the unsaturated fatty acids against oxidation. The liver oil recovered is degummed, bleached and deodourised. The process has been described in detail by Young (1982).

The liver oil from deep water sharks are important to many industries. Crude shark liver oil is processed in Japan for the preparation of cosmetic products. The squalene present in shark oil is used in the manufacture of lubricants, bacteriocides, pharmaceuticals and in cosmetics. In cosmetic products, it is incorporated to enhance skin permeability for the passage of active ingredients. Squalene is also useful to prevent formation of nitrosamines and as a stimulant to enhance synthesis of hormones by the body. The hydrogenated squalene, namely, squalane is an excellent moisturiser and carrier of fragrances. Diacyl glyceryl ethers have bacteriostatic action. They also protect against radiation and aid in the healing of wounds and inhibit tumor growth.

The world market for natural skin care products is huge and growing rapidly. The potential uses for semi-refined and refined shark liver oils con-

taining squalene are largely unexplored. These products offer excellent cosmetic ingredients. However additional work is required for evaluation and standardization of stability, safety and acceptability of shark liver oil-based cosmetic products. The production, composition and uses of shark liver oil have been discussed by Summers and Wong (1992) and are summarised in Table 2.

Marine oils are rich in unsaturated fatty acids and have therefore attracted nutritional importance. The marine oils are commercially available in capsules of gelatin, containing vitamin E as a stabilizer.

Other by-products such as fins, maws and isinglass have found application in clarification of wine, beer etc. Isinglass is produced from air bladder of fish such as eel and catfish. Cleaned, desalted, air dried and hardened swimming bladders (fish maws) are converted into thin strips of sheets. Shark teeth and bones can have application for making fancy ornaments. Crystalline guanine extracted from scales of fish can also be used for making artificial pearls (Mathew and Prabhu, 1987). Shark meat has poor value as food. Development of odourless, functional protein powder by spray-drying of shark meat has been reported recently (Venugopal *et al*, 1994).

Marine oils are rich in unsaturated fatty acids and have therefore attracted nutritional importance.

Feed for Aquaculture

Meat from under-utilized fish species can also be converted into feed for aquaculture of fish and crustacea. For this purpose, the meat is isolated from the fish, mixed with other ingredients such as silage, groundnut oil cake powder, rice bran, wheat flour, molasses and vitamin/mineral mix and ex-

Table 2 Shark Liver Oil Production, Composition and Uses

Process of Extraction from Shark Liver	
Natural decomposition (incubation at 30^0C)	
Acid ensilage, Alkali digestion	
Steam rendering (90^0C/30 min) :	80 g/100 g liver)
Composition	
Hydrocarbon (squalene, pristane)	68%
Diacyl glyceryl ether	
(Selachyl, chimyl and batyl alcohols)	26%
Triglycerides	6%
Uses	
Squalene is used in lubricants	
Squalene and squalane are used as moisturisers in cosmetics	
Diacyl glyceryl ethers have bacteriostatic action	
Used as surfactants	
For wound healing has	
Antitumour activity	

truded after steaming. The noodles are pelletised and sun-dried to a moisture content of about 10%. Feed for aquaculture is also developed by spray-drying of fish solubles.

Proteins from Effluents from Fish Meal Factories

Fish meal is a highly concentrated animal feed supplement consisting of high quality proteins, minerals and vitamins and is also one of the richest natural sources of lysine and methionine. Fish meal is, therefore, used as an animal feed in several countries. The wet reduction manufacturing process consists of cooking whole non-commercial pelagic fish species such as anchovies, menhaden or sardine in water, screening and pressing of the cooked meat, followed by wet milling and drying (Fig.2). Three main liquid by-product streams are produced during the manufacture, namely, bailwater (the transport medium for whole fish), bloodwater (the liquid exudate produced during bulk storage) and stick water (the residual watery phase from centrifugation of the cooked fish). The protein contents of these by- products range between 2.8 and 9.4%.

The stickwater is concentrated to recover the proteins. During concentration, increase in viscosity is a major impediment. The problem can be solved by treatment of the stickwater with proteases such as alcalase or neutrase to hydrolyse the proteins and therefore, to reduce the viscosity (Jacobson and Rasmussen, 1989). Physico-chemical precipitation processes have also been employed to recover the proteins. These include acidification, addition of protein coagulants such as ferric or aluminium chloride or incorporation of polyelectrolytes such as alginate, carrageenan and

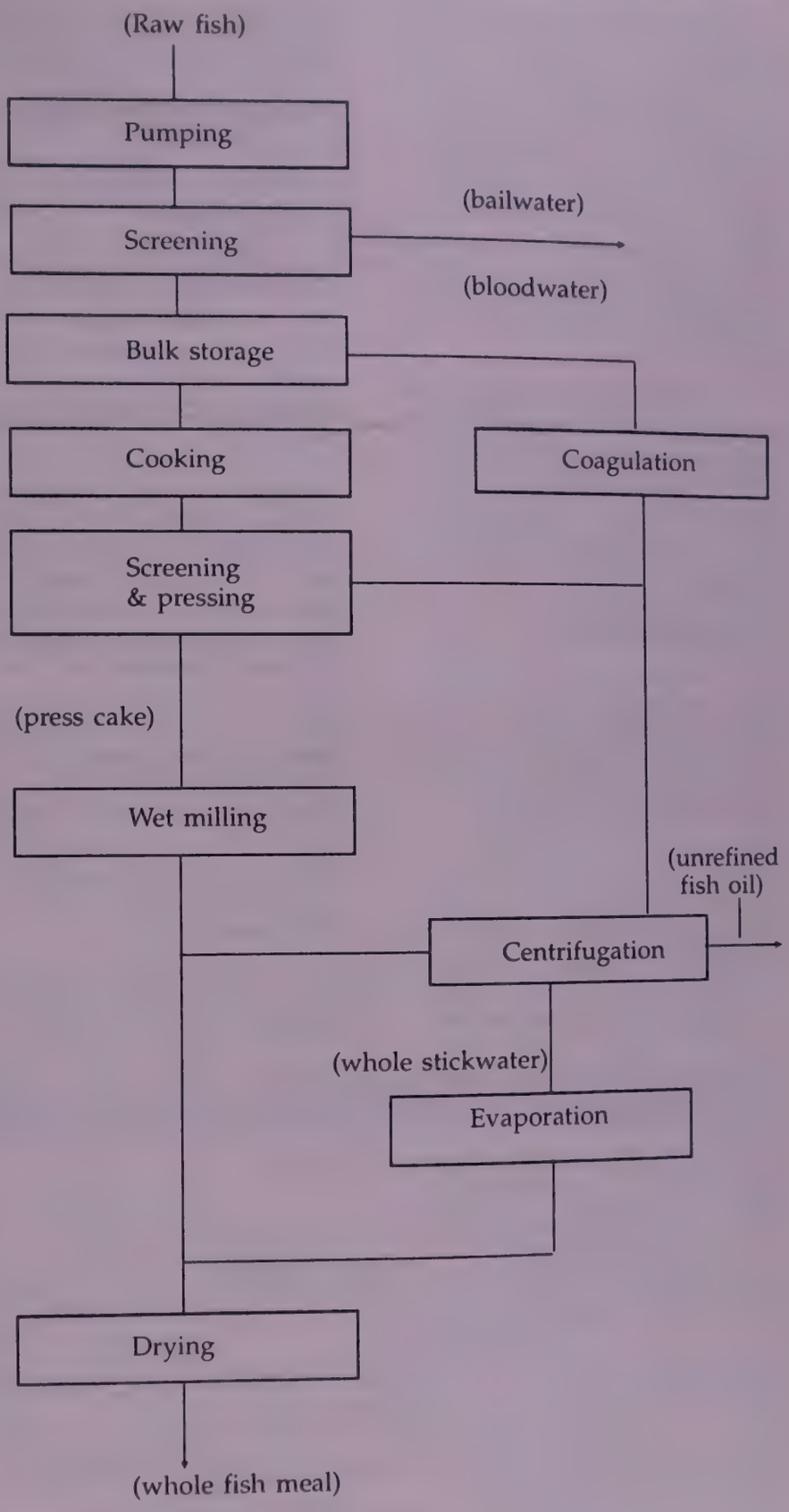

Fig. 2 Recovery of Liquid By-products from Fish Meal Factories

carboxymethyl cellulose. Optimum concentrations for the coagulation of colloidal matter in fishery processing waste water are 50-200 ppm $FeCl_3$(pH 5.0), 2000 ppm alum or 50-200 ppm polyacrylate. Electro-coagulation, ion exchange and ultrafiltration processes can also be employed for precipitation and separation of proteins in aqueous solutions (del Valle and Aguilera, 1992).

These techniques can also used for recovery of proteins and carotenoproteins from other liquid wastes of seafood processing such as effluents from scallop shucking, shrimp processing, clam, tuna or shrimp canning operations.

Seafood Flavours

Several by-products from the processing of crustacea such as lobster, shrimp, clam and also fish species such as anchovy, salmon, etc., can serve as rich sources for extraction of seafood flavours. The falvour concentrates at small concentrations (0.1 to 0.5%) can be used to enhance acceptability of processed frozen seafoods, surimi and seafood analogues, soups, sauces, seasoning blends, breaded and battered items. The flavours are recovered generally through alcoholic extraction of the raw materials and are available in powder forms (Pan, 1990 ; Anon, 1988).

Recovery of Enzymes from Fish Wastes

During commercial processing of finfish species, a large amount of offal wastes and waste fish are accumulated. Fish viscera is a rich source of digestive enzymes. During the last decade, a great deal of efforts has been made to upgrade the value of fish offal. Isolation of enzymes and nucleic acids from fish viscera is a step in this direction. The process consists of clarification of the waste water (by addition of ferric chloride) followed by ultrafiltration and freeze-drying. The material is a rich source of enzymes, such as alkaline phosphatase, hyaluronidase, acetylglucosaminidase, chitinase and proteases depending upon the source. Recovery of enzymes from shrimp waste has been mentioned earlier.

Fish proteases consist of serine (trypsin and chymotrypsin), acid (pepsin), cysteine (thiol) and metallo (collagenase) proteinases. Procedures have been developed for isolation of both acidic and alkaline proteases from salmon viscera and acidic proteases from cod and mackerel viscera using centrifugation, polyacrylic acid and ammonium sulfate precipitation, ultrafiltration and batch ion-exchange chromatography (Reece, 1988). The scheme is shown in Fig.3. Fish proteases can have several applications in the seafood industry. These consists of reduction of viscosity of stickwater and preparation of fish protein hydrolysate. Recent applications include protease-assisted removal of skin from several industrial fish species (Table 3).

Compost

Composting is a low-cost, environmentally beneficial and potentially profitable use of fisheries by-products. Variable daily amounts of fisheries wastes are difficult to accommodate in meal plants and for extrusion (for feed manufacture), liquefaction processes or recovery of individual components. However, the waste can be readily combined with other recyclable

Table 3 Uses of Proteases in Seafood Industry

Process	Reference
Reduction of viscosity of stick water	Jacobson and Rasmussen, (1984)
Fermentation (fish sauce production)	Haard (1992)
Fish protein hydrolysate	Mackie, 1982
Skin removal (e.g., tuna, herring, squid)	(Wray, 1988)
Scale removal (e.g., ocean perch, haddock)	Stefansson and Steingrunsdottir, (1990)
Roe production (e.g., salmon, trout)	Gildberg, (1993)
Membrane removal (e.g., cod liver)	Stefansson and Steingrunsdottir, (1990)
Preparation of seafood flavour (e.g., from shrimp head)	Pan, (1990)
Recovery of carotenoid pigments	Simpson and Haard, (1985)

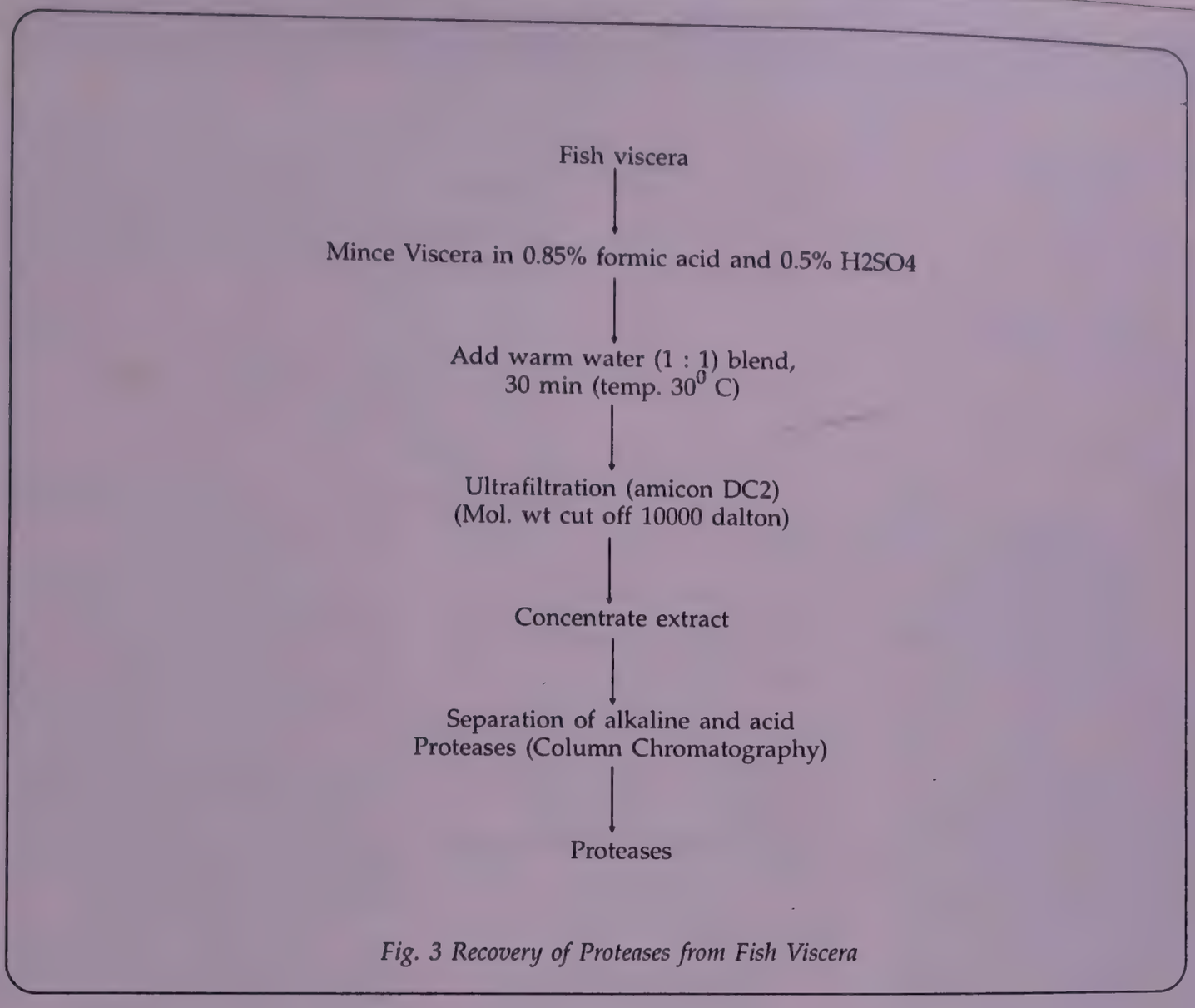

Fig. 3 Recovery of Proteases from Fish Viscera

materials and converted to useful composts. Diverse uses of such composts ranging from garden and crop manure to several innovative applications, physical and chemical properties of composts and economics of production have been discussed in a recent seminar (Sea Grant Institute, 1992).

Composting is done in static piles, using a base layer of wood chips, a composting mixture of fish processing waste and wood chips in the ratio of 1 : 3 and a cover layer of wood chips. Items such as hay, sawdust etc., can also be used as carbon source. Composting is completed usually during a period of 8 to 10 months. The maturity of compost can be determined by either self heating test, measurement of the accumulation of nitrate and the resulting drop in pH or through seed germination test. A compost is considered safe for use as a plant substrate, if it has a germination capacity of 60%. The methodology for compost preparation has been described by Mathur *et al* (1988).

Composting is a low-cost, environmentally beneficial and potentially profitable use of fisheries by-products.

Liquefaction of fish frames using fungal enzymes has been reported recently (Ferreira and Hultin, 1994).

Other Useful Items

Seaweeds

Although seaweeds may not be directly a by-product of industrial fish processing, it is one of the important marine raw materials useful for the development of several useful colloids such as agar, alginate and carrageenan. Seaweeds are classified into four main groups,

Table 4. Seaweeds

Total harvest	4 million tonnes
Potential	17 million tonnes
Used	(1) as food, 59%
	(2) for industry, 41%
Most abundant :	Brown seaweed,
	(Laminaria and ascophyllum)
	Stock of 10 m. tonnes
	Red - diverse
	Most valuable as food

50 species suitable for consumption

35 species available in Asia

Good source of B-vitamins, and also vitamins A and C

Contains minerals such as iodine, calcium and iron.

largely on the basis of pigmentation, namely, red, brown, green and blue-green seaweeds (Table 4). Red and brown seaweeds account for the majority of commercially viable seaweeds. Seaweed is used for various purposes. These include as raw material for the manufacture of colloids and for animal feed and fertilizer and as food for direct human consumption.

A colloid is a non-crystalline macromolecule, which is usually prepared from red and brown seaweeds. Developing countries produce nearly 40% of the world's seaweed supplies for the manufacture of colloids. Of this, 70% is used for agar production, 30% for carrageenan and 18% for alginates. Agar is used principally in foodstuffs as jellies, usually in combination with gelatin. It is also widely used in preparation of bacteriological media. Carrageenans may be of three types, depending upon the source of the seaweed. It is used as a stabilizing and gelatinizing agent in food and for thickening and stabilizing of products such as toothpastes. Japan uses about 20% of total available colloid. Alginate is present in most species of brown seaweed.

Non-edible Marine Products

Of the total non-edible marine products, seashells constitute the major share, followed by aquarium fish, turtles and seaweeds. The shell-craft industry in India is concentrated along the east coast in Tamil Nadu, Calcutta district of West Bengal and in Andaman and Nicobar islands. Numerous varieties of shells, including molluscs, coral and gastropods are used as raw materials in the shell-craft industry to produce beautiful ornamental and utility items. Trochus and Turbo shells are most abundant around Lakshadeep. Sea fans and seaweeds are collected, treated and used as decorative items because of their peculiar shape, design and colour (Shenoy, 1984). Although fish is a poor source of collagen, it has found application in making of surgical sutures (Hasson and Sheref, 1994, Mukundan *et al*, 1987). The use of shark teeth, scales etc., for making ornaments has been pointed out (Mathew and Prabhu, 1987).

The seafood processing industry, thus, can provide a number of valuable by-products, which can be judiciously exploited leading to better value addition.

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Indigenous Production of Shrimp Feed

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Introduction

Shrimps are organisms living in sea, estuaries and backwater. The process of growing the baby shrimps upto a marketable size in an enclosed water body is called shrimp farming. Marine shrimp forming is an age old practice. According to nature of scientific inputs and managements, shrimp farming may be classified as follows : (i) Traditional (ii) Extensive (iii) Semi-intensive and (iv) Intensive.

Global farmed shrimp production in 1993 is shown in Table 1.

Shrimp is a major export item in India. India has the advantage of long coastal line, suitable for shrimp farming. Shrimp farming is now recognised by the Government of India as a priority sector. Feed management in shrimp culture is one of the most vital steps to achieve the production target. At present, good pelletised feeds adopted to Indian conditions and formulated out of locally available ingredients, are not available. Good quality feeds are mainly imported from Taiwan and these are very costly. Of course, in India, a few entrepreneurs have started production of shrimp feeds, which are less effective than those imported feed.

Type of Feed

Depending on the size of shrimp, different types of feeds are used. These are mainly 1) Starter, 2) Grower and 3) Finisher.

Composition and size of feed are different in case of starter, grower and finisher.

The ingredients of the feed are chosen in such a way that the nutritional requirement of prawn is met.

Proximate composition of feeds is shown in Table 2.

From Table 2, it is seen that requirement of protein for baby shrimp is higher than the aged shrimp and in case of requirement of carbohydrates, the situation is just the reverse. This is similar in case of human beings.

Sizes of the pellets of starter, grower and finisher are 0.5 mm, 1 mm and 2 mm, respectively.

Raw Materials

For selection of raw materials, the following points are to be considered.

a) The ingredients of the feed are chosen in such a way that the nutritional requirement of prawn is met.

b) One of the most important factors in determining the quality of the feed is water stability of the feed. The feed is usually provided in lumps in trays. Shrimp holds the pellet between its chelates and pours into its mouth. Feed is usually provided at an interval of 6 hours. Hence, the pellet should remain intact inside water for atleast 6 hours. Care should be taken to select binding agent as well as its composition in such a way that the pellet remains stable in water for more than six hours.

c) The ingredients of the feed should be available locally as far as practicable.

d) The pellets should float on the surface of water for 15 to 30 minutes and thereafter, slowly move downwards. This will attract more shrimps to consume feed.

e) Size of the pellet should be uniform to suit various stages

* *Production Manager*

Table 1. Global Farmed Shrimp Production (1993)

Country	Area under production (ha)	Production (MT)	Rate of product (Kg/ha)
Thailand	60,000	1,55,000	2,583
Equador	90,000	90,000	1,000
Indonesia	2,00,000	80,000	400
India	80,000	60,000	750
China	1,40,000	50,000	357
Vietnam	2,00,000	40,000	200
Bangla Desh	1,10,000	30,000	273
Philippines	40,000	25,000	625
Taiwan	7,000	25,000	3,571
United States & others	900	3,000	3,333
Total	**9,27,900**	**5,58,000**	**13092**

of shrimp.

f) The keeping quality of the feed should be good at normal temperature and pressure and degeneration of the nutrients should not take place during storage.

Considering all these points, the following ingredients were tried for production of starter feed. Shrimp meal 70%, Corn meal 5%, Soya meal 5%, Rice bran 5%, Wheat flour 10%, Fish oil/Vegetable oil 4%, Vitamins and minerals 1%.

Among the vitamins and minerals, riboflavin, sodium ascorbate, calcium pantothenate have been found to be effective.

Preparation

Preparation of prawn feed indigenously consists of the following steps :

a) *Grinding* : Among the raw materials, shrimp meal, corn meal, soya meal are available in solid chunks and in different sizes. In order to produce a homogeneous mixture, it is necessary to have the uniform size of the ingredients. Shrimp meal, corn meal and soya meal are ground in a hand grinder or a mechanical grinder. Since the feed is produced at farm site, where electricity may not be available in most cases, grinding by a hand grinder is a very laborious job. Therefore, it is wise to have the raw materials ground in a mechanical grinder from outside the farm site, where electricity is available.

After grinding the raw materials, these are passed through a sieve of 1mm mesh size. Hand sieving or mechanical sieving may be done.

All the ingredients are passed through the sieve of same mesh size so that a homogeneous mixture can be achieved by mixing the ingredients.

b) *Mixing* : The raw materials are weighed separately according to composition. These are, then, added one by one in a plastic bowl and mixed intimately for atleast 20 minutes to have a uniform mixture. Automatic horizontal mixer can also be used to achieve homogeneous mixture.

Once the ingredients form a homogeneous mixture, water is added to the mixture and the mixture is kneaded thoroughly by a stirrer, until mixture sticks to the hand and forms a paste.

Table 2. Proximate Composition of Feeds

Feed type	Crude protein %	Crude fat %	Carbohydrates %	Crude fibre %	Moisture %	Ash %	Minerals %
Starter	45	8	20	3	8	14	2
Grower	40	6	25	4	8	15	2
Finisher	35	4	30	4	8	17	2

Addition of too much water is not desirable, as it may create trouble during formation of pellet. Addition of less quantity of water also leads to rupture of the pellet. It has been found that requirement of water is about 50% of the weight of the mixture. Vitamins and minerals are added at the last stage of mixing.

c) *Preparation of pellet* : The paste, thus, obtained is passed through a meat mincer. **A drawing of the mincer may be obtained from the author.** The unit is fabricated from 304 quality of stainless steel, electrically welded construction, complete with cutting knife, 2 mm perforated discharge plate, discharging chute, charging hopper, driven by 1HP/1440/220V A.C. motor, V-Pulley, V-belt etc. mounted on fabricated base frame.

However, meat mincer is also available having similar construction, but without motor, V-belt, V-pully etc., fitted with wheel for hand drive. Cost of the hand driven meat mincer is almost half of the electrically operated meat mincer. When the feed is produced in the farm site, where electricity is not available, hand driven mincer is used for preparation of the feed. According to need, capacity of the meat mincer is fixed and fabricated. Capacity of the meat mincer, fabricated by the author is 100 kgs/hour.

The mixture of the ingredients is charged at the charging hopper of the meat mincer. By screw action, pellets are obtained at the chute. Perforation of the disc is maintained according to the size of the pellet desired. The resultant pellets are spread on perforated tray for drying.

d) *Drying* : When the feed is produced in the farm site, where electricity is not available, wet pellets are sun-dried for 48 to 72 hours, until the final product attains a moisture content of less than 10%, which is desired to arrest growth of mould and fungi for a considerable period.

Drying can also be done by using a mechanical driver. Thermostatically controlled tunnel driver or tray driver can be used for this purpose. Temperature of the driver should be between 40^0c and 50^0c to protect nutritional quality of the feed. In case of mechanical drying, uniform drying is achieved and requirement of drying time is also much less, i.e., about 8 hours.

e) *Packing* : The feed, thus, produced should be kept in polythene lined synthetic bags under airtight condition. Not more than 20 kgs feed should be packed in each bag to avoid physical damage of the pellets.

f) *Storage* : The polythene lined synthetic bags containing feeds are stored in a store house, well ventilated, dry and stacked away from walls to allow air to flow on all sides of the store. The bags are stacked on wooden platform to avoid dampness from the ground. Small stacks, not more than 10 bags high, are made to avoid heat generation with other consequential damage. The inlet and outlet ventilators are covered with adequate mesh to prevent insects, birds, rodents and rats coming in. Temperature of the store house is maintained between 20^0C and 30^0C. Air conditioned store house is used by large scale producers of shrimp feed.

Usual shelf-life of shrimp feed is three months. During opening the bag, care should be taken not to keep the bag open for a long time. Open bags help loose aroma of the feed, which may reduce the feed intake by shrimps. This may also attract moisture and fungi. Care should be taken so that the feed is consumed on first-in-first-out basis and as fast as possible.

Storage room for the dry feed and ingredients are not the same. Strong toxicants, insecticides etc. are never applied on the feed stack or in the store room. This may prove fatal to shrimp through ingested contaminated feed. Storing is vital for effectiveness of the feed.

Quality Control Tests

Quality control of raw material as well as feed is done in the laboratory. The following parameters are important and determine the effectiveness of the feed.

a) *Estimation of proteins* : The proteins should be a good mixture of both animal and vegetable origin and contain the eight essential amino acids i.e., isoleucine, lysine, tryptophlan, leucine, phenylalanine, threonine, valine and methionine, as shrimp cannot synthesize them. Among the raw materials of prawn feed, shrimp meal and soya meal contain substantial quantities of proteins. Hence, crude protein content of shrimp meal and soya meal is estimated by Kjeldahl method. Crude protein content of finished product is also estimated by the same method.

b) *Estimation of fat* : The feed should contain the two essential fatty acids i.e., linoleic acid and linolenic acid. Fat content of vegetable oil/fish oil, shrimp meal, soya meal are estimated by Soxhlet fat extraction apparatus. Fat content of the feed is also estimated.

c) *Estimation of ash content* : By using muffle furnace, ash content of the shrimp feed is estimated.

d) *Estimation of moisture content* : Moisture content of prawn feed is very important. If the feed contains more that 10% moisture, then it will be easily

infested by mould and fungi. Moisture content of prawn feed is estimated by way of difference in weight before and after complete drying the prawn feed.

e) *Estimation of crude fibre, carbohydrates and vitamins* : These are estimated both for shrimp feed as well as raw materials by the AOAC methods.

f) *Water stability* : The dried pellet is tested for its stability in aqueous medium. Water stability of shrimp feed should be atleast six hours. If it dissolves before that time, it will simply pollute water, which is detrimental to the growth of shrimp. Moreover, feed will not be available for shrimps.

g) *Feed Conversion Ratio (FCR)* : Effectiveness of shrimp feed is determined by the feed conversion ratio. A good quality shrimp feed should have FCR between 1.05:1 and 1.4:1. FCR is nothing but the total quantity for feed used, divided by the total quantity to prawn harvested. FCR is usually calculated by using the feed in a small experimental pond keeping all other parameters same.

Problems

One of the major problems faced during production of prawn feed indigenously is the non-availability of shrimp meal containing low ash content. Shrimp meal is produced from dry shrimps which are sun-dried in the sandy seabeach mostly by spreading the shrimp with other small size fishes.

In order to produce the best quality shrimp feed, shrimp meal produced from mechanically dried shrimp should be used.

Dry shrimp contains sand and dust, resulting in higher ash content in the shrimp meal. However, in some places, shrimp is dried by spreading over mat or concrete floor, which contains less sand and dust. Shrimp meal produced from these dry shrimps contains low ash. In order to produce the best quality shrimp feed, shrimp meal produced from mechanically dried shrimp should be used. In view of huge demand of shrimp feed, it is a viable proposition to set up mechanical drying unit in the coastal belt for the production of good quality shrimp meal.

Application of Feed

The feed is applied by broadcasting as well as by providing in lumps in trays. Consumption of feed depends on the quality of feed, water temperature, stocking density, salinity of water and a number of factors. Consumption of feed is viewed when feed is provided in lumps in trays.

Usually feed is provided at an interval of 6 hours i.e., at 6.00 a.m., 12 noon, 6 p.m. and 12 p.m. Consumption of feed during day time is not same as night time. Feeding schedule for shrimp is shown in Table 3.

Table 3. Feeding Schedule

Type of culture	Average weight (g)	Type of feed	Feed per day % of biomass
Extensive	5 - 10	Grower	8 - 12
	10 - 15	Grower	7 - 10
	15 - above	Grower	4 - 7
Semi-intensive	0.1 - 3	Starter	10 - 12
	3 - 10	Grower - I	7 - 10
	10 - 20	Grower-II	5 - 7
	Above 20	Finisher	2 - 5
Intensive	0.5 - 1	Starter	5 - 12
	1 - 15	Grower-I	4 - 6
	15 - 20	Grower-II	3 - 4
	20 & above	Finisher	2 - 3

Conclusion

In shrimp farming, cost of feed constitutes 50% of the total cost of the project. Both

imported feed and the feed produced by big companies using modern extrusion technique are costly. Hence, indigenous production of shrimp feed at the farm site has got a definite advantage. Moreover, shrimp farms are located in rural areas, where labour is very cheap. Even the workers of the farm are not always fully engaged. Since cost of production of prawn feed is found to be much low, compared to other imported feeds, production of prawn feed at farm site is beneficial for the shrimp farmers.

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Trends in Food Consumption and Food Industry Development - A Global Perspective

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The Backdrop

Recent collapse of centrallized economic system symbolized by virtual disintegration of former Soviet Union and courting of market economy concepts through liberalization of controls and opening of markets to winds of global competition, especially by population giants like China and India, are bound to have long term repercussions on food processing sector of the industrial landscapes of many of these nations. With fast flow of foreign investments and deployment of modern technologies for food processing as well as promotion, there is a distinct possibility that one can expect marked stimulation of consumption of processed foods. Anticipated wealth generation due to significant and sustained growth of economy will logically contribute to more disposable income in the hands of the family for eventual expenditure on purchase of comfort-, leisure-, and pleasure-oriented goods including high quality, high value, processed foods. In this context, food industry will naturally be anxious to be prepared for the challenges posed by the above cataclysmic events and a close look at the changes being brought about by relative affluence in many of the already developed countries, probably can provide some indication of likely future trends in food consumption habits due to rapid industrial development in many parts of the world.

Food Consumption - Global Reality

Though a typical diet aims at meeting the minimum daily needs of both macro and micro nutrients besides dietary fibre, there exists a close relationship amongst factors like economic development, literacy and longevity (Table 1)

It can be argued that daily calorie intake may not be a correct index of health and many other factors also need to be taken into consideration, while drawing any conclusion regarding the dietary intake of calories. An individual's food requirement is invariably linked to the type of physical activity, one is compelled to do as a part of daily life regimen and it is debatable whether the 3671 calories consumed by an average American cannot be considered as over-eating, while the average Kenyan consumption of 2163 calories per capita cannot be termed inadequate for a normal healthy working adult. Development of Food Industry is closely linked to this important question and undoubtedly any dramatic growth of this sector is possible, only when calorie consumption shows quantum increase approaching 3000 per capita. Related to this is the literacy rate and longevity as these factors help to create new awareness about qualitative and quantitative aspects of food amongst the consumers.

Changing Consumer Perception

Human psychology plays an important role in forecasting of changes in the market place and industry in general depends to a large extent on the perceived/anticipated changes in the behavioural pattern of consumers, while designing new products and services. Unlike

Table 1. Food Calories and Country Development

Country	Calories (per capita)	GDP-US$ (per capita)	Longevity (Years)	Literacy (%)
USA	3671	22,595	76	95.5
Switzerland	3562	21,649	78	100.0
Japan	2956	19,642	79	100.0
Germany	3522	20,165	76	100.0
Egypt	3366	3,625	61	48.5
Kenya	2163	1,377	59	69.0
India	2229	1,198	60	52.1
China	2639	2,772	71	73.3
Australia	3216	16,930	77	99.5

animal feed sector, where cost and nutrition solely guide product design, food products development is handicapped by constantly changing consumer food habits due to a number of reasons such as monotony, monetary considerations, social changes, cultural factors, religious practices, environmental priorities, literacy, etc. It is here one has to keep pace with such changing scenario in a given environment by anticipation, based on trend analyses. Forecasting of human behaviour is fraught with enormous risks and there can be considerable deviation of what really happens from what has been forecast. Still for want of a better alternative, industry has to depend on trend analyses and forecasting, if not to be caught totally unprepared to face new challenges due to changes in food habits brought about by rapid socio-economic changes. Transformation from a predominantly centralized economy into a market oriented one will invariably bring about far-reaching changes in consumption of and expenditure on food by the population as a part of the chain reaction in response to increased disposable income and sustained market expansion. It is an irrefutable fact of history that 15 richest countries in the world with a population of less than 1 billion boast of a combined GDP of more than US$ 16 trillion, whereas 25 developing countries with a population of more than 3.5 billion account for only US$ 8 trillion, highlighting the relative disparity between "haves" and "have nots" in this planet.

Though food habits are more appropriately governed by traditions and family backgrounds, they are subjected to winds of changes due to stresses of modern living. Often one encounters situations in life, when compromise on native food tastes and habits will have to be made to cope up with fast changing economic needs. Perceptions about foods, their need, role and pattern of consumption are known to change even in a close-knit family environment with successive generations- the youngest ones being more amenable to newer foods and novel tastes. This trend is further accentuated by opportunity factors like increased economic freedom, lesser family cohesion, time constraints for in-house food preparation, enormous expansion of education, impressive growth of catering sector including the fast food phenomenon, and greater access to information through electronic media about vast array of convenience oriented food products with different features. In a country like USA, food processing sector has reached commanding heights comparing favourably with well established sectors like automobiles and pharmaceuticals. It is reported that the annual gross value of output by food industry reached a staggering 400 billion US$ in 1993, achieving a value addition of 145 billion US$. The value additions by automobile and pharma industries were 152 and 155 billion US$, respectively during the same year. If food business in a developed country like USA can be of such dimensions, the situation in other industrialized nations in Europe or Canada or Japan or Australia cannot be much different. Any perceptible trends in the attitude of the consumers *vis-a-vis* food in these affluent economies are bound to

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percolate to varying extents at least to that strata of society, which is cash-rich in newly emerging market economy countries. Today, national barriers to individual's access to other countries are progressively getting lowered due to ease of international travel, emergence of information highway for fast accessing, establishment of WTO, large volume of world trade in consumer foods estimated at US$ 140 billion, functioning of regional groups of countries like NAFTA, APEC, SAARC, etc. Food ethnicity may become a thing of the past, as many ethnic foods have already become universal knowing no national boundaries. Products like bread, cheese, ice-cream, yoghurt, beer, wine, brandy and whisky, soft drinks, soya milk, tea, coffee and cocoa, chocolate and sugar confectionery, curry paste and powder, noodles, tortillas, *roti* and *chapathi*, pizza, break fast cereals, extruded snacks, potato chips, French fry have all become international, produced and consumed even in places far away from their places of origin and their acceptance is no more limited to any particular ethnic group or nationality. History is replete with examples as to how people tend to emulate others, who are more successful than themselves and it is but natural that in the slopping ladder of development, countries at the lower rung, trying to catch-up with the others above them, strive to learn from the experiences of the latter. Thus, new trends evident in developed countries do have a spread effect and magnitude of this will vary, the most critical influencing factor being the economic strength of the consumers, which invariably goes up in market economy system. It is in this context that an overview of changing trends in food habits of consumers in general in some of the more developed countries may probably give some valuable clue regarding what can be done by the food processing sector in the event of such trends becoming a reality in their country of operation. Scanning the food horizon world-wide one cannot but help taking note of some distinct trends, which need to be taken seriously. Some of them have reached sizeable dimensions, while others are in early stages of manifestation.

Increasing Desire for Foods in Native State

During the last three decades, a number of process aids/food additives used by industry have either been restricted for use or altogether banned due to safety considerations and consumer is increasingly becoming nervous about long term health implications of using substances not endogenous to the food. In spite of stringent protocols/regimens being insisted upon for safety clearance of food additives and a plethora of bodies like ISO, WHO-FAO Alimentarius Commission, FDA of USA, etc., are constantly breathing down the neck of the food industry to ensure absolute safety of products manufactured by them. A wide spectrum of consumers are increasingly looking for foods, which are minimally processed or not processed at all in the belief that food processing invariatory data/information regarding harmful effects of food additives have helped to further alienate many consumers who do not wish to take any risks *vis-a-vis* processed foods. Food industry, though stands to lose some of their votaries due to the above trend, some see in this an opportunity to develop new food entities by exploiting this inherent scare perception. "E-Number" on labels indicating presence of permitted additives, mandatory under EEC labelling regulations, has become a taboo with many consumers and the trend is for the manufacturer to highlight that his product does not contain any "E-Number" for promoting such products. Probably, population with such high sensitivity may be less than 1% of the total consumers in a country, but they have the potential to grow at an alarming rate, if food industry and the regulatory bodies, national as well as international, do not redouble their efforts to induce more confidence in their clients about the safety aspects of both the technologies as well as the various inputs that go in formulated food products.

Importance of dietary fibre for human well being during recent years and increasing evidence about possible relationship between a number of health disorders and consumption of foods of animal origin have become common knowledge.

Progressive Decrease in Consumption of Animal Based Foods

Importance of dietary fibre for human well being during recent years and increasing evidence about possible relationship between a number of health disorders and consumption of foods of animal origin have become common knowledge amongst the well informed consumers, especially in countries with very high

literacy rates. This has led to a situation where many products are tagged with label declarations that they are free from any constituents derived from animal sources. This trend is reflected by strong showings in the market by products like imitation milk preparations with no milk solids, plant-based margarine literally replacing butter as a dietary component and soya-based meat analogs. Though meat and other animal derived foods are implicated in various health disorders like arterial atherosclerosis, impaired bowel movement, severe forms of food infections, organ malfunctions, dental decay etc., which are reported to be more prevalent amongst populations consuming high levels of these foods, the shift from animal to plant-based foods has not yet assumed any alarming proportions. In a recent Gallup poll in UK, it was brought out that during the span of last 10 years the population shunning meat altogether increased from 2.5% to 4.5% and surprisingly, one out of four in the age group of 16-24 years does not take any meat at all. Consumers, in general, seem to be slowly veering round to the view that progressive aging will have to be accompanied by reduced intake of animal products and this trend is more likely to have repercussions in countries with predominant old age populations with low birth and mortality rates. Monitoring of such demographic changes can yield valuable clue with regard to potential shifts in food preferences and prepare the industry to face the consequent challenges.

Increased Share of Fish in the Diet

Discovery of essential fatty acids and their versatile role in human nutrition have promoted practices encouraging replacement of saturated fats in the diet, at least partially with sources of fat containing high levels of triglycerides with unsaturated fatty acids. Essential fatty acids like linoleic, linolenic and arachidonic acids are involved in regulation of cholesterol metabolism, prostaglandins formation, which, in turn, regulate blood pressure, conception, delivery and transmission of nerve impulses and their deficiency can lead to dermatitis and growth retardation. Even amongst unsaturated fatty acids, ω-3 and ω-6 acids are considered to be more effective and fish is considered a rich source of ω-6 fatty acids. This development has spurred a universal campaign to increase fish intake, which would confer the population with benefits of better availability of ω-6 fatty acids. Developmental efforts to design new food products based on fish and fish oils can be expected to reap rich benefits in the market place.

Higher Consumption Levels of Vegetables and Fruits

Vegetables and fruits have equally important roles in vegetarian as well as non-vegetarian diets. In the former, they supply important micro-nutrients like vitamins and minerals, while in meat predominated food system, they provide bulk to ensure adequate intestinal motility and serve specific physiological functions. Neglect of this important group of food items in favour of others, more palatable and gastronomically satisfying to the consumer, especially after attaining economic affluence, leading to disastrous consequences, has now been well recognised. The "vegetable salad" syndrome which has become a part of the western as well as eastern eating practices is mainly due to the above realization. Virtues and advantages inherent in higher consumption of vegetables and fruits are well established and the concept has become a part of the curriculum in formal education system. Demand for fresh fruits and vegetables and their minimally processed counterparts is expected to go up in leaps and bounds with this heightened awareness and easier affordability in an industrialized society. Processing industry has the unenviable role to make them available throughout the year in prime condition by deploying modern technologies like refrigeration, freezing, modified atmosphere storage and packaging, freeze-drying, irradiation, etc. Vending of cut fruits is already popular amongst the consumers in the lower economic strata of many developing countries, but their quality and safety may not measure upto the minimum requirements, considering the poor hygiene and sanitation of the environment, where they are processed and vended. Manufacture in the organized sector of assured quality products and sustained promotion will see tremendous growth of this sector in many parts of the world.

Emergence of "Functional" and "Functionalised" Foods

If food is viewed as a vehicle for human sustenance, it can be a normal food for daily consumption. "Functional food" is a balanced formulated product created to deliver all the nutrients in pre-ordained proportions and "functionalised food," is a speciality product designed for use under nutrient-stress conditions. In the quest for better health, consumer is constantly scanning the market place for products, which

can supply major nutrients in required quantities and in balanced proportions for regular consumption so that he is spared of the worries on account of any nutritional imbalances and their consequences on health. Majority of the new products emerging in the market belong to the category of "functional foods", though they are susceptible to fast fade out and extinction if not constantly promoted. Such products serve a useful purpose by providing daily needs of most of the essential nutrients fully or to a major extent through consumption of recommended quantities, especially for growing children, work-stressed adults and aging population. During sixties and seventies, these types of products were marketed under the category of ethical medicines but now, having carved out a niche for themselves, they are being patronised as normal foods for regular consumption by population of all age groups. The growth potential in this case could be between 10 and 30%, considering the present consumption base of US$ 4-5 billion annually. Similarly, functionalised foods designed for and targetted at vulnerable population of different types are just palatable food products carrying specific food ingredients/nutrients either for direct consumption or after incorporation in the main diet. There are a number of products in this category, which include those with high proteins, high energy, high fibre, no-sugar/low sugar, low/unsaturated fat, iodine, lysine, methionine, low sodium, etc. Many such products form the backbone of many a nutritional programme at national and international levels, actively promoted with public funds. INCAPARINA (Gautemala), Multipurpose Food (India), Iodized Salt (most countries) are classical examples of mass produced functionalised food products. Markets in developed countries are witnessing dramatic increase in the range of such products available to the consumer and it is expected that this segment will witness an annual growth of 15-25%, based on the present consumption level of about US$ 4-5 billion per year.

Marginalisation of Kitchen

The position of mother in the family and kitchen in the household has been unique in the history of mankind and evolution of society. However, post-world war era has seen a slow erosion of these traditional values because of stresses created by industrial development and effects of economic prosperity. When mother is no more, the provider of food to the family and kitchen ceases to be the nerve centre of food-related activities in a household and the focussed attention, they receive is also diminished considerably. It is interesting to see how the effective area occupied by the kitchen place is becoming less and less in modern apartment type houses, especially in south-east and far-east Asian countries as the tendency is for the whole family to eat out frequently or bring packed foods in ready-to-serve form from out side for eating together. In a recent report from South Korea, it was revealed that one of the franchised units of Messrs T.G.I. Fridays, a multinational fast food chain from US, located near Seoul recorded the highest daily turn over of about US$ 49300 on 5th May 1993, while average figure in US itself never exceeded US$ 10000 per unit per day. Considering that Eastern food habits are totally different from those prevailing in the West,the above report brings out clearly the fast paced transformation taking place in societies due to industrialization and economic affluence. The trend of "eating out" is more and more discernible in many of the so-called "NIC"s (Newly Industrialized Countries) and is likely to spread to other societies as well. Challenge posed by such a change in living style can be exploited equally well by the catering industry as well as the food processing industry. Enormous expansion of street vending, catering and eateries is a sure sign of such changing attitudes and the processing sector is well advised to take note of the opportunities inherent in such a shift, which can be easily exploited by developing newer products with higher convenient factor, minimum preparation regimen built into them. It is logical to expect a sizeable part of expenditure on eating out being attracted by the sizeable part of expenditure on eating out being attracted by the processed food industry through imaginative products, comparable to freshly prepared foods in sensory quality and cost aspects.

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Disillusionment with Kitchen Gadgetry

An array of kitchen gadgets with different functional modes are serving a useful purpose in reducing kitchen drudgery and they are available in affordable price ranges. These include blenders, mixers, juice extractors, meat choppers, refrigerators and freezers, ovens, wafflers, fryers, steam boats, air pots, thermo jugs, coffee brewers, soda fountain etc. No doubt, these gadgets are very popular amongst self-assisted families without dependence on external household assistance. However, the perception of consumers regarding the credibility of the manufacturers of kitchen aids is undergoing a sea change and such a change may necessitate a hard re-look at the role and effectiveness of these gadgets with a view to make them more user-friendly. Susceptibility of refrigerators to psychrotropic pathogens like *Listeria*, inadequacy of many of the preparation gadgets in terms of product quality, problems of maintenance and performance, failure of micro-wave ovens to satisfy cooking needs are some of the visible symptoms of growing consumer disappointment with the much vaunted "new kitchen order" promised by the appliances industry. Micro-wave heating concept which was so eagerly accepted in many modern kitchens, turned out to be unworkable in practice for routine cooking of foods, though it is still the best warming / reheating device available today. Besides, its requirements of special containers like glass, ceramics or compatible plastics makes it an unlikely winner in many of the countries on the threshold of NIC status. The emerging situation thus offers both an opportunity as well as a threat to the appliances industry-opportunity for innovation to come out with more user-friendly devices and threat of annihilation, if no new developments take place in this area through sustained research and development efforts. Even on a conservative estimate, world kitchen appliances industry generate an annual turn over of US$ 8-10 billion.

Emergence of Organic Foods

Increasing awareness about damages to health caused by use of chemicals in production, conservation and processing of foods has led to the nucleation of a distinct category of consumers willing to pay any price to have access to food items raised in a natural way under natural conditions. There are a number of farms, gardens and plantations, estimated at more than 10000 in many parts of the world, geared to produce a variety of food materials without using chemical fertilizers, insecticides, pesticides, impure water, growth-promoters or any other inputs, which are not natural. Over 200 agencies mostly in the private sector are providing certification services in Europe and USA based on farm inspection to generate some confidence in the consumers regarding the genuineness of claims *vis-a-vis* organic nature of products originating from such farms. It is possible some of the countries may come up with regulatory policies to govern the trade in organic foods and protect consumer interest, as they often cost three times as much as the normal food. Conflicting reports regarding implication of many of the hitherto assumed to be safe chemical inputs used by the industry at different levels of production and processing are making more and more consumers of many of the normal market products move towards organic type of foods with least potential health hazards. According to present projections, this segment may attain an annual growth rate of 40- 50% considering that the existing base is of the order of US$ 2.5- 3.0 billion worth of annual consumption of organic foods world over.

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Growth of Vending Sector

During the last two decades, new designs of food vending equipments have revolutionised the vending concept and today a wide range of such machinery are available in terms of variety of foods to be vended, quality, mode of preparation, cold or hot, packed etc. Modern office organisation and travel/tourism activities invariably build food vending facilities as an integral part of their plans to save time and provide the highest form of convenience to the people. It is likely that automated vending units with their labour sparing potential will become landmarks in the changing landscapes of many of the countries, undergoing transformation from predominantly agrarian economy to one driven by fast industrial development, generating pressures on human resources availability. As ATM units

supplementing the conventional banking activities, vending units are a natural corollary to an expanding catering sector, spurred by increased desire to eat wherever and whenever one wants, not constrained by any logistical impediments. Similarly, street vending, formerly frowned upon by consumers belonging to the upper strata of society is fast becoming an acceptable, even a desirable, trend amongst all segments of consumers. The gastronomical stimulation on account of food being prepared in front of the consumer and the psychological rapport established between the vendor and the consumer may be major factors responsible for the spread of street vending, especially in many parts of Asia. Growing popularity of street vending has resulted in increased attention being focussed on them by researchers as well as the local health authorities with the objective of making the system safe and ensuring reasonable levels of hygiene and sanitation. Establishment of food vending complexes managed by expert entrepreneurs with some aptitude in culinary art in predominantly residential areas to cater to the local communities will become a viable proposition, as the services in the organised catering sector become cost prohibitive, especially for middle class consumers. Globally, the annual value of street foods consumed is estimated at about US$ 5-6 billions, which at the present trend of growth may exceed US$ 10 billions by the end of this decade, a major part of this growth taking place in newly industrialised countries of Asia, Africa and South America.

Revival of Traditional and Ethnic Foods

One of the early casualities of industrial development was the traditional eating habits, as preparation of traditional foods involves some degree of acquired skill, elaborate process and long time, besides being highly perishable. There is always a conflict between the desire to eat traditional foods and availability of adequate spare time to indulge in cooking such foods as and when required. Consumers, especially in the younger age group, tend to switch over to modern convenience foods under such conditions, thus compromising on the natural/inherited taste preferences. However, convenient such foods may be, the dormant and some time sub-conscious yearning for traditional foods occasionally finds expression driving them to ethnic eateries. On the other hand, to escape from the unexciting situation of regularly eating foods with same sensory profiles, many consumers are constantly on the look out for new taste experience and traditional foods characteristic of cultures of different countries, regions and communities offer an exciting range of taste and flavours. Ethnic restaurants offering authentic cuisines from various countries are doing roaring business today the world over and this trend is bringing down such ethnic barriers differentiating them and are becoming universally acceptable to a wide spectra of consumers irrespective of their ethnic origin. Recent interest on the part of food scientists in investigating and modernising traditional foods augurs well for the future of this sector in the coming years. With the existing knowledge base itself, many traditional foods of Asian, African and South American origin are likely to be made available to the market in stabilized forms with sufficient shelf-life and uniformity in quality. The number of standardized and stabilized traditional food items currently in the world markets is in the range of 150 - 200 and this will register a phenomenal growth, reaching more than 500 by the end of this decade, exceeding an annual turnover of the order of US$ 10-12 billions.

Growth of Halal Foods

Halal food system, practised by Islamic community, one of the major population groups, spread over more than 50 countries, accounting for about a billion people, may have its origin centuries ago, based on ancient concepts and traditional practices, but integration of modern scientific principles into Islamic Food Laws and continous research and international monitoring by qualified food scientists have made them a major player in the food business. Islamic Food Laws are codified today lay emphasis on cleanliness, sanitation, and purity, besides strict guide lines for maintaining the equipments used in the process. Increased reorientation of food industry to adopt halal practices, which are after-all complimentary to well accepted norms of food preparations can be expected to boost consumption of processed foods by more and more consumers from this large population group. Even on a conservative estimate, the market for processed halal foods could be as high as US$ 50-60 billions per year.

Widening Range of Medical Foods

Prevalence of in-born as well as acquired health disorders is becoming a major matter of concern in many countries and they are being treated with more and more potent drugs or through surgical intervention. Role of food in alleviating at least some of these ailments is now being recognised. Accumulated knowledge in

medical sciences including human nutrition has helped to tailor- make foods for different health disorders and a substantial segment of medical profession is veering round to the view that appropriately designed foods can supplement their treatment mode and in many cases even avoid use of drugs, which may have undesirable side-effects. True, such foods are not available easily now, as the demand and production are somewhat localised in each country. However, higher expenditure being incurred by some of the multinational pharma companies in developing new products targetted for patients undergoing medical treatments of various types is bound to be reflected in the market place by the availability of a range of foods classified as medical foods to distinguish them from normal foods consumed by healthy individuals. Formulated efficiently and promoted with the support of medical community, medical foods have the potential to attain high volume production worth more than US$ 20-25 billions per year globally.

Evolution of The Concept of "Green Foods"

Ecological concerns are becoming important considerations for every human being today and dire predictions of large scale disaster are being aired frequently as abuse of nature in the form of indiscriminate deforestation, severe pollution and fast depletion of exhaustible energy sources continues unabated. Conservation of our eco system by minimising the damage as much as possible has assumed priority in the development strategy/agenda of many countries in recent years. Against such a background was born the "Green Movement" striving to protect the earth from such continuing degradations. Though only a small population is actively/directly associated with the movement proper at present, consumers by and large seem to be supportive to the causes espoused by the movement and products made with no damage or minimum damage to the environment are increasingly catching the fancy of the consumers. "Green" foods or "eco- friendly" foods are manufactured with practically no pollution to the environment during processing as well as its subsequent life cycle. A reorientation of the attitude and approach on the part of food processing industry to manufacture more "green foods" would be necessary to avoid any likely consumer backlash in patronising processed foods and to further expand the consumer base in the coming years. More and more involvement of government agencies in environment protection measures and introduction of distinctive eco-friendly labelling/logosystem for products from non-polluting industries (a potential USP for marketing) will further accentuate the shift from normal processed foods to those brands with green label. While presently, this trend is barely perceptible probably because of the voluntary nature of such lebelling codes, many countries are reported to be actively considering making green branding mandatory within the next few years and in such an eventuality, the present "trickle" can become literally a "down pour" engulfing the entire industry. Other factors such as use of renewable source of energy, biologically degradable/recyclable packaging materials, etc., are also likely to weigh in as eligible criteria for green branding.

A reorientation of the attitude and approach on the part of food processing industry to manufacture more "green foods" would be necessary to avoid any likely consumer backlash in patronising processed foods.

Euphoria for Herbal Foods and Foods Based on Ancient Plant Materials

Ancient food systems prevalent in China, India and other older civilisations were predominantly based on many types of herbs and plant materials, which were supposed to be endowed with a variety of health boosting and disease curing properties documented in native literature. Remarkable rise of Ginseng root during sixties and seventies as a wonder herb with an astonishing range of vital attributes, claimed to be beneficial to human beings is a classical example of consumers patronising a product of ancient origin, not because of any convincing modern medical evidence, but due to values attached to it traditionally in South East Asia. The "Ginseng" syndrome seems to be spreading fast and there are many new products emerging in the market under the category of herbal foods to exploit the new found consumer confidence/belief in the ability of herbs to cure many deseases, which defy modern medicines. Though scientific evidence may be lacking in many cases to substantiate the claims, some time exaggerated,

the increasing allegiance to such foods is a sure sign, industry cannot ignore altogether, as many consumers find solace in the philosophy that herbal food, even if not effective for the purpose it is taken, will not cause any damage to health, due to its established use for centuries. Based on the present trend, herbal foods sector will become a major force to reckon with, within a decade and the business volume can be expected to cross the US$ 10 billion mark by the year 2000 from the present level of US$ 4-5 billion.

Consumer Bias for Fast Energy Rich Food Products

The fallacy of "quick restoration energy" is assidously being promoted by a section of pharmaceutical industry, which appears to have caught the imagination of many a consumer and a vast array of energy-rich beverage products claiming to restore instantly metabolic energy drained off by active children, working adults and athletic community due to physical work out, are becoming part of regular family diet. It is well known that while rigorous physical activity can deplete the glycogen level in the body very fast, repletion to the original level can take as long as 20 hours under normal conditions. High glycaemic foods can accelerate the process of restoration, when consumed during repletion stage after performance of the physical activity to some extent. Glycaemic index studies related to blood glucose concentration attained over a period of 120 minutes after assimilation of food clearly bring out the fact that while legumes, pasta products and even some varieties of cooked rice do take time for complete release of glucose, many others like white bread, fast cereals, potato, etc., can readily yield substantial part of their energy content within two hours as manifested by glucose build-up in the blood. It is a debatable point whether in real life situation, human beings are benefitted at all by such products claiming to release energy instantly. In human gastrointestinal system, most of the nutrient absorption takes place in the small intestine and food has to reach this point after oral ingestion, through the esophagus and the stomach sections taking at least 30-90 minutes. Under these circumstances, any claim for instant energy release by any food product, except may be alcohol, which is known to be absorbed even from the esophagus, might not be realistic. Nonetheless, these types of products have already carved out a niche for themselves and it may be unrealistic to expect any reversal of this trend in the foreseeable future. The demand for instant energy products, in fact, appears to be growing significantly and food industry may as well capitalise on it by design and development of more efficient products of this nature, while working out more transparent labelling guidelines so that consumers will have true information regarding energy release efficiency of such products, compared to a standard/familiar product. Similar in concept is the range of products being marketted for "quick restoration of water balance" using isotonic formulae, which are popular in tropical and arid regions of the world consumed to counteract dehydration and loss of minerals through sweat glands. These two categories of products have already developed into a US$ 30 billion industry with an annual growth rate of 25-30%.

The economic dimension of food processing industry is influenced by the extent of processed foods finding its way in the day-to-day menu of the family.

Food Industry Development - Global Scenario

The status of food processing sector varies in different countries depending on a variety of factors. While basic food is an essential inevitable input for life sustenance, the form, the shape and the mode of presentation will determine how much processing it has undergone. The economic dimension of food processing industry is influenced by the extent of processed foods finding its way in the day-to-day menu of the family. This, in turn, is affected by many country, specific development indicators - such as intensity of technology deployed, percentage family income spent on foods, population and its growth rate, per capita GDP and savings, literacy rate, life expectancy and per capita calorie intake.

Technology Intensity Index (TII) : If foods can be classified into raw (fresh) primary processed, secondary processed and tertiary processed,, the extent of technology deployed in their manufacture progressively increases with tertiary processed products, requiring most sophisticated technology. TII of a country's food industry can be computed by knowing the proportion of each of the above categories of food contributing to the total value of production by that industry in that country (Tables 2&3).

On a scale of 0.25 to 1.0,

Table 2 : Food Products-Grouping and Weighted Scores

Type of foods	Examples	Weighted score
Raw (Fresh)	Fruits, Vegetables, Meat, Egg, Fish	1
Primary processed	Refrigerated foods, milled rice, Legume splits, sun-dried foods, Fluid milk, Jaggery	2
Secondary processed	Refined flours, Refined oil, Shortening, Refined sugar, Ready mixes, Dehydrated foods, Frozen foods, Pasta goods, Essential oils, Oleoresins	3
Tertiary processed	Canned foods, Confectionery, Dairy products, Beverages, Soft drinks, Snacks, Bakery goods, Breakfast foods, Instant products	4

TII would be progressively higher with higher percentage of tertiary processed products in the total production. As illustrative examples, assume two countries A&B having the following production profiles and their TII figures are calculated as follows :

When a country's food industry is predominated by activities related to simple food conservation measures, the TII values tend to be closer to 0.25, while those converting the raw materials into products with highest value addition possible will have the corresponding figures closer to 1.0

Food Expenditure Index (FEI): A comparison of average per capita expenditure incurred on foods in different countries can be a valuable indicator of the economic dimensions of the food industry. Taking the maximum figure recorded in a country like USA as unity, the comparative expenditures in other countries can be expressed as a fraction of the maximum score of one, which is designated as FEI.

Population Index (PI) and Population Growth Index (PGI) : As population of a country has a decided influence on the size of food industry there, any development scenario to be visualised will have to reckon with the total population as well as their growth rates. Here, population of China, which is the highest in the world today is taken as unity and population index figures for other countries are computed as fractions of one. Similarly, the population growth rate in Kenya (4.1%), which is one of highest in the world is taken as unity for computation of PGI for other countries as fractions of one.

Table 3 : Computation of Technology Intensity Index

Type of foods	% in Total	Score TII
	Country A	
Raw	40	40 x 1/100=0.4
Primary processed	30	30 x 3/100=0.6
Secondary processed	20	20 x 3/100=0.6
Tertiary processed	10	10 x 4/100=0.4
Total	**100**	**2.0 2.0/4=0.50**
	Country B	
Raw	10	10 x 1/100=0.1
Primary processed	20	20 x 2/100=0.4
Secondary processed	20	20 x 3/100=0.6
Tertiary processed	50	50 x 4/100=2.0
Total	**100**	**3.1 3.1/4=0.78**

GDP Index (GDPI) and GDP Savings Index (GDSI) : The wealth of a nation is reflected in the gross domestic product and the savings by the population. These factors do play a role in accelerating the consumption rate of consumer products and hence have an influence on the development of industrial sector. In the comity of nations, USA boasts of the highest per capita GDP, while China has the largest savings of GDP and these values are taken as unity of GDPI and GDSI, respectively and the corresponding values for other countries calculated as fractions of one.

Literacy Index (LI) : It is a fact that most of the major countries occupying the top of the industrial development scale or the asset scale have literacy rates touching 100%, while many poorer countries have very high proportions of illiterate populations. General knowledge about science, nutrition and health is a major driving force for the consumer to appreciate and recognise the advantages of processed foods, in general, and newer products, in particular, which gets translated into buying in the market place leading to continuous growth of food industry. Literacy rate, thus, has to be kept in view in any futuristic scenario, drawing exercise and to incorporate this factor into a composite index, 100% literacy is taken as unity. Countries with varying literacy rates are given fractional scores, depending on percentage literacy achieved by them and designated as LI values.

Life Expectancy Index (EI) : Implied in achieving longevity is the accessibility to good food. The close relationship between longevity and industrial development is apparent from the fact that most of the developed countries of the world have attained life expectancy levels approaching 80 years. Availability of good quality processed foods and a range of speciallity foods can be ensured only when the food processing sector has the necessary strength and resources to meet these needs. Life expectancy of 76 years and above is taken as equivalent to a score of one for computing and expressing value, which is the ratio of life expectancy level achieved by a country in number of years to 76.

Calorie Consumption Index (CCI) : Development of food industry is closely linked to per capita food calorie consumption in any given country. Invariably in most of the industrially advanced countries, the calorie consumption is in the range of 2800-3500 per capita, while this figure drops to 2000-2500 level in many of the poorer countries. This factor is integrated into the food industry development index (FIDI) by taking a percapita consumption of 3500 calories as unity and working out the CCI of various countries as a fraction of this, derived from average values for per capita calorie intake in each country.

Taking into reckoning the above variable factors which play some role in the development of food industry in a country, a composite scale has been evolved, which is useful in evaluating the overall status of the food industry in any given country. Individual country index is arrived at, by adding the nine separate indices and then multiplying by 100. Higher the score, more developed is the food industry and *vice-versa*. FIDI values based on the above are calculated for India, Malaysia, USA, China, Germany, Nigeria and Brazil and they are shown in Table 4.

It is known that the food

Table 4 : Food Industry Development Index

Index	Countries							
	India	Malaysia	USA	China	Germany	Japan	Nigeria	Brazil
TII	0.65	0.80	0.95	0.65	0.90	0.80	0.62	0.73
FEI	0.07	0.35	1.00	0.12	0.94	0.90	0.24	0.42
PI	0.82	0.02	0.24	1.00	0.08	0.10	0.08	0.16
PGI	0.53	0.85	0.40	0.30	0.18	0.10	0.80	0.48
GDPI	0.05	0.30	1.00	0.10	1.00	0.90	0.08	0.26
GDSI	0.16	0.04	0.83	1.00	0.50	0.15	0.19	0.29
LI	0.52	0.79	0.96	0.73	1.00	1.00	0.51	0.81
LEI	0.75	0.88	0.96	0.88	1.00	1.00	0.65	0.83
CCI	0.60	0.76	1.00	0.80	1.00	0.85	0.65	0.72
Cum-Score (CS)	4.15	4.79	7.34	5.58	6.60	5.80	3.82	4.70
FIDI * (CS x 100)	415	479	734	558	660	580	382	470

* An FIDI value of less than 400 is an indication that the food industry is relatively weak; between 400 and 600 reasonably strong and beyond 600 very strong.

Table 5 : Food Industry Potentiality Index

Index	Country							
	India	Malaysia	USA	China	Germany	Japan	Nigeria	Brazil
(1-TII)	0.35	0.20	0.05	0.35	0.10	0.20	0.38	0.27
(1-FEI)	0.93	0.65	0.00	0.88	0.06	0.10	0.76	0.58
(1-GDPI)	0.95	0.70	0.00	0.90	0.00	0.10	0.92	0.74
(1-LI)	0.48	0.31	0.04	0.27	0.00	0.00	0.35	0.17
(1-LEI)	0.25	0.12	0.04	0.12	0.00	0.00	0.35	0.17
(1-CCI)	0.40	0.24	0.00	0.20	0.00	0.15	0.35	0.28
(GDSI)	0.16	0.04	0.83	1.00	0.50	0.15	0.19	0.29
Total (T)	**3.52**	**2.26**	**0.96**	**3.72**	**0.66**	**0.70**	**3.44**	**2.52**
Cum-Score (CS) = (T x 100)	352	226	96	372	66	70	344	252
PF	1.35	0.87	0.64	1.30	0.26	0.20	0.88	0.64
FIPI (CS x PF)*	475.2	196.6	61.4	483.6	17.6	14.0	302.7	161.3

* An FIPI value of 100 or less indicates practically no potential for new investment in food sector, most of the growth potential being restricted to projects for new or improved products replacing the existing ones or with higher value addition or for modernisation of technology ; 100-200 reflects regular incremental growth, mostly to keep up with population growth, investment potential being 50-500 million US$/year; beyond 200, one can expect an annual investment potential of more than one billion US$ on new food industrial projects.

sector in USA, consisting of over 16000 manufacturers with an annual production valued at US$ 400 billion is well established with a strong technological base and very high value addition capability. Naturally, with an FIDI of 734, it is much ahead of the European giant Germany with FIDI of 660. The strength of US Food Industry lies mainly in its large consumption base due to higher population and bigger GDP savings. China with a FIDI of 558 lags behind because of lower indices for TII, FEI, GDPI, LI and CCI, but its existing strength is derived mostly from population and GDP savings, both highest in the world. A country like India, whose strength is only in terms of a large population, lags behind in all other indices and with an FIDI of 415 has a lot to catch up with. Brazil, in spite of having significantly higher per capita GDP, still has a relatively low FIDI score of 470 because of lower values for PI, PGI and GDSI. Similarly, Nigeria, a resource-rich country in Africa, has a low FIDI score of 382 because of low GDPI, smaller population and lower values of LI, LEI and CCI. The FIDI profiling gives a clearer picture of the overall development status of food industry in a country and brings out factors that are responsible for its existing strength and weakness.

While government has the major responsibility to evolve congenial policy framework with user-friendly features, private sector will have to come in a big way to invest vast resources needed to climb fast on the vertical ladder of all round development in as short a time as possible.

Food Industry Potentiality Index (FIPI)

The investment potential in food industry in a country is the major reckoner for new investors in deciding about the advisability or otherwise of their plans to go in for new ventures and the same factors, which are used to compute FIDI scores can be used for arriving at Food Industry Potentiality Index (FIPI). This is done by calculating values for (1-TII), (1-FEI), (1-GDPI),(1-LI), (1-LEI), (1-CCI) and adding them to GDSI value to get a cumulative score. The PI and PGI values are summed up separately to get country specific population factor (PF). FIPI is arrived at by multiplying the cumulative score

first with the PF value and then with 100. It can be seen from Table 5 that in terms of potentiality, China comes out on top followed by India.
Population and population growth, both are critical factors that stimulate higher food consumption and hence the two population giants with a vast untapped market offer a high opportunity factor to investors. Naturally, when the figures for various indices go up due to continuous and sustained development, the FIPI will tend to move downward approaching figures in the range of 150-200. However, it may take a number of years for such countries like China and India with high populations to bring up indices like FEI, GDPI, LI, LEI, CCI etc., to level comparable to those prevalent in currently affluent countries.

Meeting the Challenges

As a general guide, FIDI of any country can register impressive increase only if concerted efforts are made to (a) upgrade technological capability by a judicial policy of global accessing and indigenous research and development (b) vastly improve the infrastructure by massive investment on sectors like power, transport, communication, market facilities, education and R&D (c) accelerate, more value addition to native resources as well as imported inputs, more export of value-added products, increased foreign exchange reserves and higher content of capital goods in the import basket. While government has the major responsibility to evolve congenial policy framework with user-friendly features, private sector will have to come in a big way to invest vast resources needed to climb fast on the vertical ladder of all round development in as short a time as possible.

CFTRI Annual Conference (20th and 21st October 1995)

The Central Food Technological Research Institute, Mysore started in 21st October 1950, is in the middle of 4th decade of its existence with many achievements to its credit. This premier Institute of the country, exclusively working on the R&D aspects of Post-harvest Technology, is celebrating its annual day this year with an emphasis on building up of a strong bridge between the Institute and Industries/Consumers. The CFTRI Annual Conference this year is scheduled to be held coinciding with the annual day celebrations of CFTRI on 20th and 21st October 1995. During these two days, about 400 industrialists of food processing industries are expected to participate and have an interaction with the Scientists of CFTRI. This will help to create a better understanding between CFTRI and Industry. The problems faced by industries can be understood by face to face meetings, so that CFTRI can offer solutions to the problems of these industries. CFTRI at this juncture, when there is policy liberalization, fiscal incentives and the motivated globalization for Indian products, is committed to assist the food industries in a more efficient and effective manner.

NEW MACHINERY

Dough Kneading Machine

Elma Industries offers a rigid type of dough kneading machine which is suitable for use in bakeries, hotels and restaurants. The machine has capacity from 10 kg to 60 kg. Kneading pan is made of 16 gauge stainless steel sheets. Fitted with heavy duty standard best quality motors, the machine has totally enclosed type gear system with pulley drive, and double action movement.

For more details write to :
Elma Industries
A/15 Aaram Society, Vokola
Santa Cruz (East),
Bombay - 400 055

Centrifugal Pump

Mapex Pumps (India) Pvt Ltd manufactures centrifugal pumps. These pumps are available in SS-316 and CI and from 1 HP. Features are ; simple design, maintenance-free, pumps with mechanical shaft seals (leak-proof) and self-aligning motor mounted pump. These pumps come in motor mounted or pedestal mounted and are useful in food processing industries.

For more details write to :
Mapex Pumps (India) Pvt Ltd
303 Vikas Buildings, 11 NGN
Vaidya Marg
Fort, Bombay - 400 001

Energy Efficient Evaporation Concentrator

The evaporation concentrators from Kehems are for chemical or food industry solutions. These are also used for concentrating polluted industrial waste waters before they are discharged. The evaporators have the following features ; reduced heat exchange surface, large range of evaporation temperatures, lack of priming of liquid scale limitation, excellent energy efficiency, simple, compact design and easy installation. The solution to be concentrated evaporates on the outside of a horizontal tube bundle, while the heat required for concentration is the condensation heat released by low pressure steam condensing inside the tubes. Spraying trays or nozzles, installed above the tubes distribute the solution uniformly, which trickles around the tubes as a mixture of thin film and droplets. The concentrators are suitable for chemical industry : soda, ammonium sulphate, sodium sulphate, aluminate, etc., food industry : milk, lactoserum, fruit juice, soya, sugar solutions, etc ; paper industry : black liquor, green liquor, etc ; and pollution : acid or basic liquid wastes, waste oil emulsions, etc.

For more details write to :
Kehems Consultants Pvt Ltd
1 Dharmodaya, Jivdaya Lane,
LBS Marg
Ghatkopar (West),
Bombay - 400 086

Salt Contamination Meter

Elecometer Instruments Ltd, has released the SCM 400 (Elecometer model 130) as an addition to its range of surface preparation instruments.

Freedom from surface contamination prior to painting is as important as the specification of the paint and its correct application in achieving corrosion protection. SCM 400 enables reliable determination of salt contamination to be made on metallic, non-metallic, irregular and non-planar surfaces and in bends. The SCM 400 is portable battery-operated and designed for on-site spot checks of salt contamination. Supplied as a kit with instrument and all the required accessories packed in a high quality aluminium case, it comes with a comprehensive guide to its use and interpretation of the readings.

For more details write to :
Eleco Instruments Ltd
Edge Lane, Droybsden,
Manchester M 436 BU, UK.

Automatic Pouch Sealer

Sealers India, manufacturer of various types of sealing machines to meet the packing requirement of various industries, has introduced an automatic pouch sealer. The machine operates in both auto and manual modes. When the selector switch is positioned at "auto", the sealing jaw closes automatically at the desired interval. The sealing time and

dwell time can be controlled with separate controls. If the operator cannot cope up with the speed, he can select "manual" position, and the machine is operated with the help of a foot switch. The machine can seal around 600 to 800 pouches per hour. It is available with both impulse as well as continuous sealing system.

For more details write to :
Sealers India
B-15 Annexe, Mugappair Indl Estate (West)
Madras - 600 050

Mixing Machine

Srugo Machines Engineering Ltd, Israel, manufactures a range of mixing machines for use in chemical, pharmaceutical, food processing, printing inks, adhesives and paint industries. The range includes : Duplanet kneader mixer with dissolving unit, Homorex emulsifier mixer, Multimix multi-processor, vacuum mixer, rapid batch ribbon blenders and vacuum driers, sigma kneaders, V-shaped twin blenders, double cone thorough blenders, Dussolver twin shaft mixers, high shear dissolver mixers, and turbo portable agitators.

For more details write to :
Moktali Engineering company
94-A, Chhani Road, Opp Octroi Naka,
Vadodara - 390 010, Gujarat

SS Centrifugal Process Pump

Joyam offers SS centrifugal process pumps, manufactured by Om Enterprise and ranging from 0.5 HP to 12.5 HP and capacity from 8000 1 to 80,000 1 for a liquid head of 2.5-50 m. The pumps are useful in dairies and breweries and in the beverages, pharmaceutical, food, chemical, cosmetics, textile, petrochemicals, and other industries. They have good mechanical seal to suit the requirements of the food industries; the seal eliminates all leakages. The small and compact pumps come in monoblock and coupled types.

For more details write to :
Joyam Engineers & Consultants
C-1 Payal Apartment, Near Swastic Char Rasta
Navrangpura,
Ahmedabad - 380 009, Gujarat

pH Analyser with Auto-stand and Printer

Labindia has introduced this system for pH measurement. Routine pH measurement is a monotonous job and demands continuous operator attention. The company has developed a printer interface for its pH analyser, so that it could be attached to any standard printer available at the user end. This eliminates the need for watching the readings and noting them down continuously. Of course, it also eliminates the chances of human error creeping into the results. The industrial print format gives day, date, time of reading and pH and mV values. The Auto-stand's beakerplate senses the presence of beaker and stirs the liquid for homogeneous mixing. It stops after preset time to allow the liquid to stabilise. Then, pH and temperature probes descend into the liquid and stay there for preset time. The pH analyser takes the readings, displays them on the LCD simultaneously prints them out on the printer, while the user is busy arranging for the second set of sampling. The probes ascend out of the liquid automatically after the set time. This completes one cycle and one set of readings. The user has to just replace the beaker for new set.

For more details write to :
Labindia Instruments Pvt Ltd
201 Nand Chambers, LBS Marg
Near Vandana Cinema,
Thane - 400 602, Maharashtra

Extrusion Lines for Food Processing

Automated, but simple, versatile and easy to operate, these turnkey extrusion lines can be designed to suit the requirements of small and large enterprises. The lines are intended for production of mass-consumption food items such as snacks, pellets for frying, pre-cooked flours, instant preparation cereals, soups and baby foods, texturized soyabean proteins, biscuits, animal feeds and packaging systems. The multipurpose line, which incorporates several units in one single plant, allows a variety of raw materials.

For more details write to :
Inbramaq Industria Breasileira de Maquinas
Avenida Predisente Kennedy 2000-Lagoinha
CEP 14.095-220, Ribeiraa
Petro-SP, Brazil.

NIR Moisture Meters

Kett Electric Laboratory, Japan, manufactures NIR moisture meters. The principle used in these moisture meters is the water molecules within substances absorb near infrared

Continued on page 52

RESEARCH ROUND-UP

CFTRI Director Speaks

With the the multinationals making rapid forays into the Indian Food Processing Industry, the CFTRI's approach to the problems facing our food industries assumes great importance. In this context, the views expounded by the Director, CFTRI at a recent press meet is significant. We are glad to reproduce below the excerpts of his press meet. (Chief Editor)

Dr. V. Prakash, Director of the Central Food Technological Research Institute (CFTRI), talking to presspersons recently, said that with the emergence of the new market economy and the increasing demand for quality products by consumers, industrial houses were now seeking the CFTRI's services, which until recently had "been in isolation" except in assisting the Government and a few private sector industries in the sphere of food technology. "Industrialists were, perhaps, shy to approach us till recently, but are now showing greater interest in utilising our sevices," he said.

He explained the crucial role played by the Institute in the country's third major industrial sector of food processing and referred to the limitations that private industries had in maintaining separate research units to check and improve the quality of their products. It is because of these limitations, private industries are now showing interest and investing in the CFTRI to utilise its services. The Institute has a well-knit team of experts in different fields of food processing and has modern infrastructure to undertake basic research to develop the latest technology for use both by the Government and the private sector, of course at a price," he said.

Dr. Prakash said with the development of science and technology, food processing, including fruits processing was not facing much difficulty today, but the challenge of maintaining "freshness" in varieties of fruits was yet to be met. "The CFTRI is currently concerned with this important aspect and working on it to develop a fool-proof technology, which will enable it to maintain the freshness of a fruit for a considerable period of time."

Stating that the Institute's main thrust was on nutrition and hygiene, and improvement in food processing, where it had a major role to play vis-a-vis quality, he said that more than 300 processing technologies had been developed by CFTRI. Giving an example of how important the role of the Institute was in serving the needs of the food industry, he said simple home technology could be used in the preparation of quality of pickles but, it needed a professional approach in producing them for mass consumption. This was where the CFTRI came in, he added.

Considering the need for pesticide-free agriculture and horticulture produce, Dr. Prakash advocated sterilisation-techniques at pre- and post-harvest levels so that the end-product did not lose its nutrient and hygienic values. If the quality of raw material used by the food industry was poor, there was no guarantee that the final product would be of good quality, he said, maintaining that preserving quality of food crops from the initial stages of cultivation was essential.

Stating that the Institute had taken up a few projects exclusively for the sterilisation of spices (which had a tremendous export potential). Dr. Prakash said importers were keen on procuring only pesticide-free spices. Importers had already expressed their concern on the pesticide-content in different spices. The CFTRI was working in this area to meet the local demand for specific technology to remove pesticide residuals in spices, he said. Dr. Prakash said considerable attention was given to human resource development (HRD) in the Institute.

Several training courses connected with food-processing had been conducted to enable trained hands to serve both the industry and society in maintaining quality, nutrients and hygienic-values in food products. He said quality was given special emphasis during the training period by limiting the size of intake to 400 candidates per year, who were exposed both to the latest and traditional food technologies, and were trained in different subjects.

Pointing out the increasing quality consciousness in consumers when even young children were aware of various brand names, Dr. Prakash suggested the introduction of a short-term course at the high-school level to create awareness about quality, nutrients and hygienic values in food products. Such a step would go a long way in making

people more quality-conscious which, in turn, would force the industry to supply quality products, he felt.

To a question, he refused to accept the "fast-food" industry as an important from the west and said India excelled all other countries in this regard.

Dr. Prakash expressed a desire to work on ragi which was an important crop with a high nutrient value. He said harnessing the potential of traditional crops by the food industry, was important.

NEW MACHINERY Continued from page 50

light. These moisture meters are optical instruments, which can instantaneously measure moisture content without touching or damaging the product which is measured. These instruments measure the moisture content of materials based up on molecular level energy absorption. The readings obtained are free from measurement errors, which occur from the evaporation of volatiles, as differentiated from moisture, when drying methods are used. Additionally, the readings are not affected by the presence of interfering substance, as they are in the Karl Fischer method. These instruments make complete measurements within 2 to 3 seconds of placing the sample in the viewing area. These can measure samples of extremely low moisture content (0.01%) such as chemical raw material and finished products. Products can also be measured which have very high moisture contents such as jellies, slurries and pastes. Since these instruments analyse moisture content by the radiation of near-infrared light, there are no restrictions in regard to the shapes of the materials being measured. These instruments can make measurements on materials, which have projections or concavities, grooves, or measure through a glass or plastic windows. Products which care powders, flakes, bulk or sheet (fibre and texture) can all be measured, as well as various liquid samples. Easy-to-clean side and cover glasses are available for liquids to ensure error-free measurement of glossy surface materials. This near-IR moisture measurement does not deform or dry the sample, nor does it affect its quality.

For more details write to :
Tara International
56/7 Botawala Building, Bomanji Master Lane
Bombay - 400 002.

CFTRI HIGHLIGHTS

CFTRI Develops a Process for the Production of *Spirulina* - The Wonder Algae

Spirulina is a microscopic plant form of algae that grows naturally in fresh water. The plant has vast application in practically all aspects of human life. *Spirulina* has high protein content, with the essential amino acids and vitamins. The protein efficiency ratio of *spirulina* is very high owing to its unicellular form.

Spirulina has extensive use in food/feed and drug industry.

The World Health Organisation found *spirulina* to be an excellent food for human consumption. *Spirulina* has the approval of Food and Drugs Authority of United States for being sold as a natural food.

Spirulina can be easily incorporated in medical formulations owing to its excellent natural composition. It could be used for treatment in anaemia, diabetes and healing of wounds. It helps in lowering of cholesterol in blood.

Spirulina can be used as a protein food supplement for malnourished children.

A natural package of proteins, vitamins and minerals, *spirulina* is extremely popular as a health food and taken for instant energy synthesis. It can be successfully used as a supplement in feeds for poultry, cattle, pig and aquaculture.

Spirulina is ideally suited in the manufacture of face creams, as it has a high protein content, a range of natural pigments and vitamins, all essential for maintaining a healthy skin. It is also used as a colourant for both food and cosmetics.

CFTRI has developed a process for the production of *spirulina* which involves three major steps. Selected strains are used for cultivation of algae in specially constructed water tanks, where the water is constantly agitated. The algae is then harvested and the biomass is recovered. It is then dried, pulverised to get desired particle size. The dry *spirulina* is then packed in polythene covers.

Yield of *Spirulina* is $10g/M^2/day$ and is guaranteed by CFTRI. The culture is guaranteed for stability in a suitable medium. The product is more economical compared to foreign technology. The project cost is Rs. 150 lakhs with capacity of 15 MT/annum. The land required is 2-3 acres.

For further information; please contact the Director, CFTRI, Mysore - 570 013.

Mango Cereal Flakes

With the entry of multinationals, introducing cereal flakes as a breakfast item, the cereal flakes are slowly making a dent into our traditional breakfast pattern. To add nutrition and taste to the conventional cereal flakes, a process for the preparation of mango cereal flakes has been developed at CFTRI, Mysore. The product is prepared by mixing mango pulp with wheat flour or *maida* and sugars and drying by passing through a drum drier. The product is obtained in the form of a thin sheet which can be broken into small pieces (flakes) and used.

Alphonso, Thothapuri, Raspuri, Safeda or Dashehari mango pulps singly or in combination can be used for the purpose. The product contains very high quantities of b-carotene and most of the other vitamins and minerals present in the original pulp.

The flakes possess a pleasant characteristic mango flavour. It is a ready-to-eat cereal flake and can be consumed along with milk as breakfast cereal flakes being sweet and crisp, this can be consumed directly as a confectionery item or as a flavouring material in ice creams.

Using a similar process, cereal flakes based on papaya, banana and guava can also be produced.

For details contact :
Director
CFTRI
Mysore - 570 013

RAW MATERIALS

Dwarf Clove in the Offing

Green revolution has been the direct aftermath of the dwarfing genes discovered in wheat and rice during the sixtees.

Dwarfism has its advantage in perennial spices too. Besides facilitating easy and less expensive harvesting, dwarf tree genotypes enable to increase the plant population per hectare and to develop novel intercropping patterns.

Clove (*Syzygium aromaticum* M. & P) is an evergreen multibranched tree, reaching a height of 15-20 metres; planted at a spacing of 7 x 7m. Clove buds are harvested by hand picking the flower buds. Harvesting of clove is a relatively labour intensive process and scafolding is a must for harvesting the buds from the extreme tip of the branches.

India produces only about 1500 MT of clove from an estimated area of 1855 ha, whereas the domestic consumption of clove in our country is 4000 MT per annum. This difference in production and consumption is met through import of clove from other producing countries.

Crop improvement in clove would go a long way in increasing clove production in India. Better crop ideotypes in clove having compact canopy size, which facilitate easy harvesting is one aspect that demands scientific attention. The dwarf clove genotype located by the scientists of NRCS, Kozhikode attains special significance in this context. This natural variant (2 Nos.) was spotted in a large private clove garden of Kanyakumari district, Tamil Nadu.

This dwarf gene source may usher in a new dawn in clove production in the country, as the dwarfing 'Dee-Gee-Woo-Gen' and 'Norin 10' have revolutionized rice and wheat production, respectively over the world.

Courtesy :
NRCS News Letter

Tomatoes of Salem

Come February-March, quadrapeds in Mecheri, Vazhappadi and Ayodhyapattinam belt in Salem district of Tamil Nadu have a heyday. Throughout this period, their food is mostly tomato.

Ever heard of a 20 kg basket of tomatoes selling at Rs.3 to 5 ? This is the plight of at least 20,000 farmers in these areas.

Mr. C Vyapuri, Convener, United Agriculturists' Association, point out that this has been the scenario year after year.

Salem district has 4,800 hectares under tomato of the State are of 15,700 hectares. However, production-wise, the district has recorded 30 tonnes per hectare whereas the State average is 25.6 tonnes. Thus this district produces virtually 35 per cent of the State output of 4.02 lakh tonnes.

The Mecheri tract is known for rainfed tomatoes which is one of the major crops, the other being groundnut. Even those cultivating groundnut used to reserve a portion of land for tomatoes.

The entire cultivation in this tract is dependent on rains through it is just 15 km from the Mettur Dam. The water available in this region is adequate enough only to nurture the nurseries. The important villages that contribute to the tomato market in this tract are Mecheri, Vellar, Pukkampatty, Malligundham, Koonandiyur, Kuttappatty, Vridhasampatty and Nangavalli.

The Ayodhaypattinam and and Vazhappaddi regions also produce mostly rainfed tomatoes and they are also very big markets like Mecheri.

Tomato is a five-month crop whose economic yield begins by the end of November and lasts even upto February-end.

According to the Mecheri farmers, at the initial stages-during November end and December. The price used to be very good, even to an extent of Rs. 120 to 150 per basket. Most of the load is usually transported to Tiruchi, Bangalore and Madras.

The glut occurs due to computation especially from the Ayodhyapattinam tract in this district and also from Hosur (Dharmapuri district) and Pollachi (Coimbatore district) by January. Price slump starts invariably after Pongal.

In 1993, the situation was so bad that a basket had to be sold for just Rs. 3. "Many farmers did not bother even to pick the tomatoes as picking charges were much higher than the prices obtained," said Mr. Vyapuri, Even during the

current year, a basket was selling at between Rs. 8 and Rs 10 (around 50 paise per kg in the retail).

An agricultural scientist told that the farmers were raising varieties such as Pusaruby, PKM-1 and Paiyur-1, which were eminently suitable for the dry tract. These tomatoes had a better shelf life than most other varieties as they could be stored in the open for even 10 to 15 days. Their skin was thicker and hence they did not get crushed in packing. These tomatoes had more citrus content. But they were smaller.

He also pointed out that these farmers could not use their land until they got some rain and every year they had to depend upon tomatoes for some income. Hence, the slump in the prices, year after year, was a 'serious blow to the farming community."

Some vegetable merchants said the farmers would be happy if they were to get even Rs. 50 to 60 per basket throughout the season, instead of facing serious price fluctuations.

Mr. Vyapuri is of the firm opinion that unless a major fruit processing plant, either in the Government or the private sector, comes up in the district, this situation would continue to haunt the farmers.

However, Mr. S. Sathyanarayanan, President of the Salem- Dharmapuri Chamber of commerce and former expert of the United National Industrial Development Organisation (UNIDO), point out that tomato produced in the Mecheri and Ayodhyapattinam tracts are seedy and very small in size. When a well-established fruit processing unit at Bangalore was approached, it did not approve of the quality of these tomatoes. They were even prepared to supply hybrid seeds.

Hence, he suggested that the tomato growers could get hybrid quality seeds and other inputs from such units and supply them the fruit at a pre-fixed price.

The profitability of the processing unit depended upon the quality and cost of the raw materials. According to him, the favoured varieties are ; Karnataka (each weighing 200 mg) ; Naveen (80 gm) ; Mangala (120 gm) and Sheetal (120 gm).

He also pointed out that international market for tomato paste, juice, etc., is huge. In 1990, Japan imported 40,000 tonnes of tomato paste and EEC countries purchased 2.9 lakh tones. It is used for making sauce, ketchup and also as an additive in cooking.

He was also of the opinion that establishment of a fruit processing unit in this district should not be delayed any further, if the farming community was to be spared the annual agony.

As Salem district produces 24,000 tonnes of mango, slightly more than pineapple output, about 16,000 tonnes of citrus fruits, and 5,000 tonnes of guava, they should also be taken advantage of. Besides, the adjacent district like Dharmapuri has the highest mango production in the entire State - more than 2.5 lakh tonnes. Processing of at least a portion of this could also be attempted.

The major markets for these items were Europe, Gulf and South East Asia. Foreign companies were willing to enter into agreement to buy back the production.

ADVERTISERS' INDEX

DATA BANK

Shares of Different Commodities in Total Agricultural Exports (in %)

Year	Coffee	Tea	Sugar & molasses	Raw cotton	Rice	Fish & fish prod	Meat & meat prod	Fruits vegetables & pulses	Processed foods	Others
1960-61	2.46	43.66	1.06	4.23	0.00	1.76	0.35	2.11	0.35	20.77
1970-71	5.13	30.39	5.95	2.87	1.03	6.37	0.62	2.46	0.82	6.57
1980-81	10.40	20.71	1.94	8.02	10.89	10.55	2.72	3.89	1.75	8.85
1985-86	8.78	20.74	0.53	2.25	6.49	13.55	2.45	4.11	2.72	11.63
1990-91	3.99	16.94	0.60	13.39	7.31	15.20	2.22	3.37	3.37	9.02
1991-92	4.04	14.73	1.91	3.71	9.19	17.54	2.81	4.28	3.71	9.31
1992-93	3.98	10.33	3.74	1.92	10.32	18.43	2.72	3.87	3.94	7.32

Source : Business India

World Rice Exports

Australia	15.6%
China	9.1%
India	5.3%
Pakistan	8.5%
Thailand	26.0%
U.S.A.	17.5%
Vietnam	13.0%
Others	15.6%

Source : Rice India

Composition of India's Exports of Marine Products

Frozen shrimp	67%
Frozen fish	13%
Frozen squid	9%
Others	11%

Source : Business India

Rice Exports (Basmati)

Basmati rice exports	Rs. crores	% growth
'88-89	333.53	
'89-90	412.20	23.58
'90-91	286.12	30.10
'91-92	435.12	51.02
'92-93	699.83	60.83
Estimated Exports		
'93-94	874.78	-
'94-95	1093.67	-
'95-96	1366.84	-
'96-97	1708.55	-

Source : Rice India

Where Nestle's Turnover Comes from (in 1994)

Infant milk formulae	17%
Exports	17%
Milk products	13%
Infant Cereals	13%
Institutional sales	9%
Foods (Noodles, gravy bases etc.)	8%
Chocolates, confectionery	5%
Soya products	1%
Others	1%

How Nestle Rates Compete with Others - A Comparison

Nestles	
Noodles	91%
Dehydrated powder	79%
Infant cereals	79%
Sauces	49%
Coffee	49%
Dairy whiteners	47%
Infant milk food	29%
Chocolates	11%
White health beverages	5%
Milk powder	3%
Confectionery	1%
Tea	1%
Brook Bond Lipton (India)	
Milk powder	32%
Dairy whiteners	9%
Coffee	49%
Tea	78%
Noodles	6%
Sauces	32%
GCMMF	
Milk powder	58%
Dairy whiteners	35%
Infant milk foods	57%
chocolates	5%
Tata tea	
Tea	10%
Parle Products	
Confectionery	12%
Smithkline Beecham	
White health beverages	68%
Cadbury India	
Chocolates	70%

Source : Business Today

Jam Market Shares : Sweet Spread

	1992	1993
Druk	5.7%	5.1%
SIL	1.8%	5.8%
Kissan	65.2%	69.0%
Rex	2.5%	2.0%
Others	24.8%	8.1%

The north has overtaken the south as the largest jam market in 1993. The fastest-growing market is the west, where demand rose by 33 per cent. The four metros account for 42 per cent of the jam market. The mixed fruit flavour is the most popular one in the south. *Source : Business Today*

TRADE FAIRS & GET-TOGETHERS

Course on Chocolate and Sugar Confectionery by CFTRI

The Central Food Technological Research Institute will be conducting a short term training programme on Chocolate and Sugar confectionery from 07th Aug to 17th Aug 1995.

The objective of the course, training charges and desirable qualification are given below.

Outline of the Course

I. Hard boiled confections

Sugars and their application in the confectionery industry.

Processing of hard boiled confections.

Additives of hard-bioled confectionery.

Faults, causes and remedies in hard-boiled confectionery

Quality control in hard-boiled confectionery.

Preparation of hard-boiled confections in the laboratory.

Analysis of hard-boiled confections.

II. Chocolate

Ingredients used in chocolate manufacture

Physico-chemical properties of fat in chocolate.

Processing of chocolate.

Preparation of chocolate in the laboratory.

Analysis of chocolate fats.

Desirable Qualification

The minimum academic qualification required is basic degree in science/agriculture/ technology/engineering or allied fields. Industrial personnel associated with production/R&D/HRD management ; Research Fellows ; Academic staff are also eligible to attend the course. This may be relaxed in case of personnel having adequate experience in the field, but should have studied Science subjects at least in Pre-university or 12th standard. As the medium of instruction is English, knowledge of the same is essential.

Training Charges Per participant

The details of the training charges are as indicated below :

a. Training Fee	Rs 3200/-
b. Boarding Charges	Rs 1055/-
c. Lodging Charges	325/-
Total Training Charges	Rs 4580/-

Please send bio-data along with the training charges of Rs. 4850/= by a crossed draft in favour of Director, CFTRI, Mysore.

Course on Fumigation, Pest Control and Prophylactic Treatment

The Central Food Technological Research Institute will be conducting a short term training course from 21st Aug to 4th Sept. 1995

The course content, desirable qualification and training charges of the course of the said course are as follows :

Course Content

The Training includes the following topics, both Theory and Practicals on

Insect pest of stored grains.

Effects of pest on grains and their detection

Economic importance of insect pests in non-food materials.

Detection of infestation

Household insect/pest problems in hospitals, theatres, food mill, food processing units, tobacco etc.

Rodent pests of economic importance and their control.

Fumigants and their properties, detection and monitoring and analysis.

Fumigation equipment

Carbon dioxide fumigation.

Aeration and prophylactic treatments.

Pesticide use as protectants.

Formulation spray equipments.

Occupational and their control in stored products.

ISI/PFA specification and registration protocols.

Integrated pest management.

Desirable Qualification

The minimum qualification prescribed is a degree in science/agriculture/technology/ engineering. This is relaxed in case of Trainees who have studied at least Physics, Chemistry and Mathematics at the Pre-university or 12th standard and have adequate

practicals/working knowledge. The medium of instruction is English.

Training Charges

a. Training Fee	Rs 3200/-
b. Board Charges	Rs 1300/-
c. Lodging Charges on Institute campus	Rs 400/-
Total	Rs 4900/-

Kindly send Bio-data along with the Training Charges in favour of Director CFTRI, Mysore by crossed bank Draft, by 1st week of August 1995.

Course on Technology of Fruit and Vegetable Products

The Central Food Technological Research Insitute will be conducting a short term training programme on Technology of Fruit and Vegetable Products from 11th Sept. to 29th Sept. 1995.

Desirable Qualification

The minimum academic qualification required is a basic Degree in science/agriculture/engineering or allied fields. This may be relaxed in case of personnel having adequate experience in the field, but should have studied Science subjects at least in Pre- university/XII std. As the medium of instruction is English, a knowledge of the same is essential.

Outline of Training Programme Content

The training programme covers lectures, analysis, practicals and demonstrations of the following aspects.

General principles of fruit and vegetable preservation

Desirable characteristics of fruits and vegetables necessary for processing

Metal, glass and flexible packaging

Testing of cans and tinplate

Basic principles of thermal processing and determination of process requirements

Preparation of syrup and brine

Canning of fruits and vegetables

Processing of fruit juice, fruit juice beverages, chemical preservation, fruit juice concentrates and aroma recovery

Aseptic packaging of fruit juices, pulps and concentrates

Chemistry and technology of pectin production

Jams, jelly and marmalade, pickles and chutneys

Preserves, candied and crystallised fruits

Freezing of fruits and vegetables

Dehydration of fruits and vegetables

Tomato products

Quality standards and specifications

Estimation of sugar, acidity, SO_2, benzoic acid and vitamins

Microbiology of fruit and vegetable products

Waste disposal and waste for processing of fruits and vegetables

Plant and machinery requirements and equipment layout

Group discussion and field visit to fruit and vegetable processing factories.

The Training Charges

Training Fee	Rs 4200/-
Board Charges	Rs 1620/-
Lodging Charges	Rs 500/-
Total Charges	Rs 6320/-

Please send bio-data and training charges of Rs 6320/- by crossed Bank Draft drawn in favour of Director CFTRI, Mysore, before 15th August 1995.

Food Service International Hospitality, Catering and Accommodation Industry Trade Show

The above show will be held in Auckland, New Zealand from August 13-15, 1995
For details contact :
XPO Exhibitions Ltd.,
P.O. Box 9682
New Market, Anckland,
New Zealand
Fax : 01480-407677

PROPAK Packaging and Food processing

The above event will take place from August 22-25, 1995 in Shnghai, China

For details contact :
Hongkong Exhibition Services Ltd
Uni 902, Shiu Lam Building
9/F, 23 Luard Road, Wanchai
Honkong, Fax : (842) 2528-3103

BOOKS

The Asean Directory of Importers 1995

MDC publishers and printers SDN BHD of Malaysia have brought out "The Asean Directory of Importers 1995". This directory in 2 volumes will be of great value to the business community in India, as it provides addresses of the importing houses of the products dealt in six Asian countries viz., Brunei, Indonesia, Malaysia, Philippines, Singapore and Thailand. The directory has been especially designed and compiled for manufacturers, exporters and trading firms who wish to expand sales to ASEAN countries. It facilitates the entrepreneur's aggressive search for new overseas business contacts by providing qualified sales leads among over 50,000 major importers of a wide variety of products. An alphabetical index has been compiled to facilitate easy location of the addresses.

Total pages 2500, Price US$ 185/= for 2 volumes inclusive postage.

For enquiries write to :
MDC Publishers Printers
SDN BHD
2717 & 2718, Jalan Empat,
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Ulu Kelang, 53300, Kuala Lumpur
Tel : 4086600/1/2
Fax : 03-4081506.

AWARDS

Jawaharlal Nehru Award for Research

Dr. H.M. Jayaprakasha has been awarded the Prestigious Jawaharlal Nehru Award for outstanding research contribution in the field of Dairy Technology. This award is instituted by the Indian Council of Agriculture Research, Government of India, for the outstanding post-graduate research in the field of Agriculture.
Dr. Jayaprakasha received this award on 11th March 1995 in New Delhi from the Honourable Minister of Agriculture Dr. Balaram Jhakar. The award carries a medal, citation certificate and a cash prize of Rs. 10,000/-.

Dr. Jayaprakasha is the Treasurer of AFST(I), Bangalore Chapter for the year 1995-96.

Announcement

ICFoST
Annual Convention
On
Food Process Engineering - Recent Trends and Developments

September 7-9, 1995
Mysore, India

Jointly organised by

Association of Food Scientists & Technologists (India), Mysore

and

Central Food Technological Research Institute, Mysore

Along with a number of Co-sponsors

Technical Programme : Lead Papers and Keynote Presentations on

* Cryogenic engineering in food processing
* Supercritical fluid extraction technology
* High pressure technology
* Heat and cooling processes
* Process design and evaluation
* Extrusion cooking
* Bio-engineering
* Food machinery development
* Packaging, storage & distribution engineering
* Membrane processing

Poster Session on : Food Science and Technology Subjects

Exhibition : Equipments, Machinery, Books, Journals, Chemicals, Glasswares, etc.

Food Industrialists, Food Scientists, Food Technologists and Food Engineers from India and Abroad are expected to participate.

For further details contact :

Dr. K. Udaya Sankar

Hon. Exec. Secretary, AFST(I), CFTRI Campus, Mysore - 570 013

Telefax : 91-821-521747 and E-mail : afst @ nicfos.ernet.in

AFST(I) NEWS

Kharagpur Chapter

The Annual General body Meeting of the AFST(I) Kharagpur Chapter has elected the following office bearers for the year 1995-96.

President :
Prof. H. Das
Professor
Agril, and Food Engineering Dept.
IIT, Kharagpur

Vic-President :
Mr. R.K. Jain

Senior Research Officer
PHTC, Agril. & Food Engg., Dept.,
IIT, Kharagpur

Secretary :
Dr. D. Das
Assistant Professor
Chemical Engineering Department
IIT, Kharagpur

Joint Secretary :
Mr. L.K. Sinha
(Scientist at CIAE, Bhopal)
Research Scholar, PHTC,
Agril. and Food Engineering Dept.
IIT, Kharagpur

Treasurer :
Mr. K.K. Singh
(Scientist at CIAE, Bhopal)
Research Scholar, PHTC
Agril. and Food Engineering Dept.
IIT, Kharagpur.

PLACEMENT SEEKERS

SITUATION AVAILABLE

A Quality Control Chemist

Wanted a Quality Control Chemist for Quality Assurance of Spices. The candidate should be well-versed with testing of various spices as per the requirements of Agmark, ISI, PFA, ASTA, FDA and be able to test the product quality attributes independently. Minimum qualification is a B.Sc. with about 3 to 5 years experience in the relevant field. The remuneration offered will be commensurate to attract the best talent.

Please Send your resume to :
Indian food Industry
Box 04/95/1
CFTRI Campus
Mysore 570 013.

Be Sure That You Are At
ICFoST '95
in Mysore from 7 Sept - 9 Sept 1995

JFST CONTENTS

JOURNAL OF FOOD SCIENCE AND TECHNOLOGY

Volume 32 Number 4 JULY/AUGUST, 1995

AFST(I) EDUCATION AND PUBLICATION TRUST (REGD)

Objectives :

* **To promote the following activities in the areas of Food Science, Food Technology, Food Engineering and Utilization/Treatment of Food Industry By-products/Wastes :**
  * Research and development activities.
  * Improved publication of information.
  * Popularization among students, professionals and general public.
  * Publication of literature and text books.
* **Other major activities in the above specific subject areas are :**
  * To recognize excellence in R & D.
  * To provide adequate publicity and support to training programmes.
  * To arrange seminars, symposia and special lectures by eminent scientists,
  * To institute and award scholarships and fellowships to deserving students.

For Scholarships/Fellowships, Grants, Seed Fund for Book Publication and other particulars, please contact :

Ex-officio Secretary
AFST(I) Education & Publication Trust
AFST(I) Office, CFTRI Campus,
Mysore - 570 013, India.

Discount Sales

Back-Issues of

"Journal of Food Science and Technology"

Few copies of some of the back-issues of the 'Journal of Food Science and Technology' are available at Discount Rates.

For further details, please contact :

Honorary Secretary, AFST(I),
CFTRI Campus, Mysore - 570 013, India

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